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Epidemiology and Disease Surveillance Portfolio

Deployment Surveillance Summary, U.S. Army Operation Iraqi Freedom/ Operation New Dawn/Operation Enduring Freedom, 2011

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14. ABSTRACT
The aims of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF)/Operation New Dawn (OND) are to: a. Describe the relative impact of injury compared to that of disease for calendar year (CY) 2011. b. Document non-battle injury (NBI) rates and trends from 2003 to 2011. c. Identify leading causes and diagnoses of NBI for CY 2011. d. Summarize key U.S. Army Public Health Command (USAPHC) CY 2011 analytic deployment surveillance projects on injuries among deployed Soldiers. e. Make recommendations for the improvement of Army injury prevention based on data analyzed. Routinely collected air evacuation, inpatient hospitalization, and casualty data provide the basis for deployment injury surveillance during current Army deployments in support of OIF/OND and OEF. NBI was notably the most significant cause of medical evacuations. As in previous years, the proportion of air-evacuated NBIs is larger than that of battle injuries (BIs) and any other single category of disease and it greatly impacts readiness. As in CY 2010, NBI was second to digestive diseases for OND hospitalizations and second to BIs for OEF hospitalizations. Similar to previous reports, the leading causes of these NBIs indicate that many are likely preventable. Timely reporting of injury rates, types, and causes should allow commanders and Army leaders to focus their attention on prevention strategies and policies during ongoing operations.

15. SUBJECT TERMS
Army, military, injury, NBIs, surveillance, OIF, OEF, OND

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EXECUTIVE SUMMARY
INJURY PREVENTION REPORT NO. S.0000614-10
U.S. ARMY OPERATION IRAQI FREEDOM/OPERATION NEW DAWN/OPERATION ENDURING FREEDOM DEPLOYMENT INJURY SURVEILLANCE SUMMARY
1 JANUARY 2011–31 DECEMBER 2011

1. PURPOSE. The aims of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF)/Operation New Dawn (OND) are to:

a. Describe the relative impact of injury compared to that of disease for calendar year (CY) 2011.

b. Document non-battle injury (NBI) rates and trends from 2003 to 2011.

c. Identify leading causes and diagnoses of NBI for CY 2011.

d. Summarize key U.S. Army Public Health Command (USAPHC) CY 2011 analytic deployment surveillance projects on injuries among deployed Soldiers.

e. Make recommendations for the improvement of Army injury prevention based on data analyzed.

2. CONCLUSIONS.

a. Routine Deployment Injury Surveillance Summary 2011, Army OIF/OND and OEF. Routinely collected air evacuation, inpatient hospitalization, and casualty data provide the basis for deployment injury surveillance during current Army deployments in support of OIF/OND and OEF. NBI was notably the most significant cause of medical evacuations. As in previous years, the proportion of air-evacuated NBIs is larger than that of battle injuries (BIs) and any other single category of disease and it greatly impacts readiness. As in CY 2010, NBI was second to digestive diseases for OND hospitalizations and second to BIs for OEF hospitalizations. Similar to previous reports, the leading causes of these NBIs indicate that many are likely preventable. Timely reporting of injury rates, types, and causes should allow commanders and Army leaders to focus their attention on prevention strategies and policies during ongoing operations.

b. Special Analytic Deployment Injury Surveillance Project Summaries, 2011.

(1) More Soldiers were air evacuated for NBIs (34 percent) than for BIs (17 percent) or any single category of disease. Sports/physical training, falls/jumps, and blunt trauma are among the leading causes of NBIs for deployed Soldiers.

(2) Battle Injuries (23 percent) are the leading in-theatre hospitalizations followed by NBIs (19 percent) for both OIF and OEF. For medical evacuations, NBI (34 percent) was the leading cause followed by BI (17 percent).

3. RECOMMENDATIONS.

a. Continue routine surveillance of deployment injuries and annual updates of this deployment injury surveillance report.

b. Link additional data sources, such as levels IV and V hospitalizations and disability records, to provide an enhanced description of deployment injuries and their outcomes.

c. Continue investigation to identify modifiable risk factors that contribute to the leading causes of injury.

d. Focus attention on strategies to prevent injuries from sports/physical training, falls/jumps, and land transport mishaps.

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U.S. ARMY OPERATION IRAQI FREEDOM/OPERATION/NEW DAWN /OPERATION ENDURING FREEDOM DEPLOYMENT INJURY SURVEILLANCE SUMMARY
1 JANUARY–31 DECEMBER 2011

1. REFERENCES. References are listed in Appendix A.

2. PURPOSE. The aims of this report on injuries to Soldiers engaged in Operation Iraqi Freedom (OIF)/Operation New Dawn (OND) and Operation Enduring Freedom (OEF) are to –

a. Describe the relative impact of injury compared to disease for calendar year (CY) 2011.

b. Document non-battle injury (NBI) rates and trends from 2003 to 2011.

c. Identify leading diagnoses and causes of NBI for CY 2011.

d. Summarize key U.S. Army Public Health Command (USAPHC) CY 2011 analytic deployment surveillance projects on injuries among deployed Soldiers.

e. Make recommendations for the improvement of Army injury prevention based on data analyzed.

3. AUTHORITY. Army Regulation (AR) 40-5, *Preventive Medicine,* 25 May 2007; Section 2-19.

4. ROUTINE DEPLOYMENT INJURY SURVEILLANCE SUMMARY, ARMY OIF/OND AND OEF, 2011.

a. Background. Injuries are a major health problem confronting U.S. military forces in garrison and combat operations.[1,2] For past conflicts, data on injuries were available only after the conflict. For more recent conflicts, there was timelier, on-going reporting of both battle injuries (BIs) and non-battle injuries (NBIs). For the operations in Iraq and Afghanistan, NBIs have accounted for a larger proportion of medical air evacuations than BIs or any other individual disease diagnosis group.[3-9] Operations in Iraq (OIF) came to an end in 2010, which is evidenced by the results in this report. Though along with Operation Enduring Freedom (OEF), Operation New Dawn (OND) was still in effect to focus on advising and assisting Iraq's Security Forces.[10] This affected the rates of Battle and Non-battle injuries for calendar year 2011. Previous deployment injury

surveillance reports have provided injury rates and trends that were used to develop targeted prevention efforts for those injuries with the highest or increasing rates.[8-12] To prevent injuries, knowledge of the causes of injuries is also needed. The data in this report are unique in that they identify the causes of NBI in addition to BI. This report provides a foundation for setting deployment injury prevention priorities based on the magnitude, severity, and causes of injuries.

b. Methods.

(1) Population.

(a) This report describes BIs and NBIs among all deployed Army Soldiers (active duty, Reserve, and National Guard) in support of OND and OEF from 1 January 2011 through 31 December 2011 that resulted in:

i. Air evacuation from the Central Command (CENTCOM) area of responsibility (AOR),

ii. Hospitalization in the CENTCOM AOR, and/or

iii. Death.

(2) Data Sources.

(a) Air-evacuated Injuries. Injury data for Soldiers air evacuated from CENTCOM were obtained from the U.S. Transportation Command's Regulating and Command and Control Evacuation System (TRAC^{2}ES). These data are routinely collected and used to request and coordinate medical air evacuation of Service members with serious injuries and diseases.

(b) Hospitalized Injuries. Standard Inpatient Data Records (SIDR) for hospitalizations in the CENTCOM AOR were obtained from the Patient Administration Systems and Biostatistics Activity (PASBA), a component of the Decision Support Center, Office of the Surgeon General. These electronic records were created from medical records that were forwarded to PASBA after Soldiers were hospitalized during deployments. These SIDR records are the official electronic record of a hospitalization in a Department of Defense (DOD) medical facility.

(c) Fatal Injuries.

i. Fatal Non-battle Injuries. Fatality data for the number and causes of NBI deaths and for the number of deaths from disease were obtained from the Defense Casualty Information Processing System (DCIPS). These data are routinely collected and used for casualty tracking and mortuary affairs. DCIPS is maintained by the Army's Casualty and Memorial Affairs Operations Center, U.S. Army Human Resources Command.

ii. Fatal Battle Injuries. Fatality data for the number and causes of BI deaths were obtained from the Defense Manpower Data Center (DMDC).

(3) Identification and Description of Injury Cases.

(a) Relative Importance of Injury and Disease. Primary Diagnosis Groups from the International Classification of Diseases, 9th Revision, Clinical Module (ICD-9-CM) and BI/NBI/Disease indicators in the air evacuation records (TRAC^{2}ES) and hospitalization records (SIDR) were used to determine the relative importance of injuries (NBI and BI) and diseases among all medical air evacuations from CENTCOM and hospitalizations within CENTCOM.

(b) Exclusion Criteria.

i. A 60-day air evacuation exclusion was used to prevent the double counting of Soldiers who were air evacuated from CENTCOM for the same diagnosis within a 60-day timeframe of the initial event. All out-of-CENTCOM air evacuation patient movements are included.

ii. Similarly, a 30-day hospitalization exclusion was used so that injury hospitalizations for the same diagnosis (3-digit ICD-9-CM code) in the same individual within a 30-day timeframe of the initial event were not included in the analysis. This 30-day timeframe accounts for distinct injuries, considering that some injuries required multiple hospitalizations.

iii. Injuries that required air evacuation within CENTCOM only (that is, further evacuation from CENTCOM was not required) were excluded from the air evacuation analyses.

(c) Injury Rate Calculations. Injury rates for NBIs and BIs have been calculated in this report. An annual injury rate was determined by dividing the number of injured Soldiers for the year by the total number of deployed person-years for that year. Information for number of deployed persons per year was obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate. [13]

(d) Causes of Injury (NBIs and BIs).

i. Air-evacuated Injuries. The type of intent (intentional and unintentional) and the causes of injury were identified from narrative patient histories in the air evacuation records. Trained coders used the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050, 5th Edition (Military Agency for Standardization, 1989) coding scheme to categorize the causes of injury.(14)

ii. Hospitalized Injuries. The intent of injury and STANAG-coded causes of injury were already present in the in-CENTCOM hospitalization records (SIDR) from PASBA and were used to determine the intent and cause of injury.

iii. Fatal Non-battle Injuries. Intent and causes of fatal NBIs were identified from casualty reports in DCIPS records. As with the air evacuation records, trained coders used the STANAG coding scheme to categorize the cause of injury.

iv. Fatal Battle Injuries. Causes of fatal BIs were included in the fatality data from DMDC and were used to determine the cause of injury.

(e) Type of Injury by Body Region Matrices for NBIs.

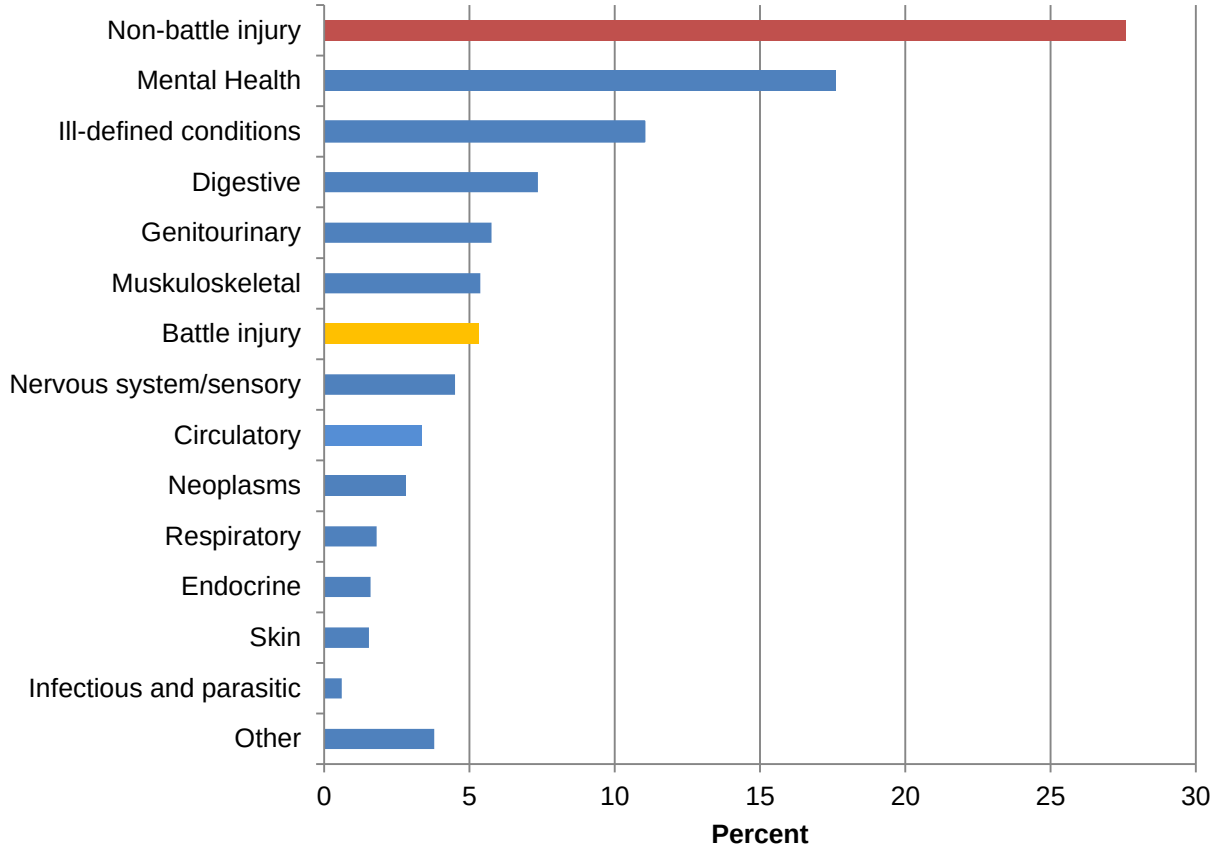
i. The NBIs were categorized into two subgroups: 1) acute traumatic injuries and 2) injury-related musculoskeletal conditions. A matrix was used to categorize the injuries in each of the NBI subgroups by injury type (such as fracture, dislocation, sprain/strain, etc.) and body region.

ii. The Barell injury matrix(15) was used to display injury frequencies for acute traumatic NBIs (ICD-9-CM codes 800-995; see Appendix B) in a standardized format in which the type of injury is listed horizontally, across the top of the table, and the body region is listed vertically, along the left side of the table. Two Barell matrices are shown; one includes only those NBIs that required out-of-CENTCOM air evacuation, and the other includes only those NBIs that required in-theater hospitalization.

iii. A similar matrix format was used to display the frequencies of injury-related musculoskeletal conditions (subset of ICD-9-CM codes 719-739; see Appendix C). Two musculoskeletal matrices are shown; one includes only those NBIs that required out-of-CENTCOM air evacuation, and the other includes only those NBIs that required in-theater hospitalization.

c. Results.

(1) Medical air evacuation distribution, OND. Figure 1 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for the OND out-of-CENTCOM medical air evacuations in CY 2011.



Note: Includes injury and disease resulting in out-of-CENTCOM air evacuation for 1,823 Soldiers.

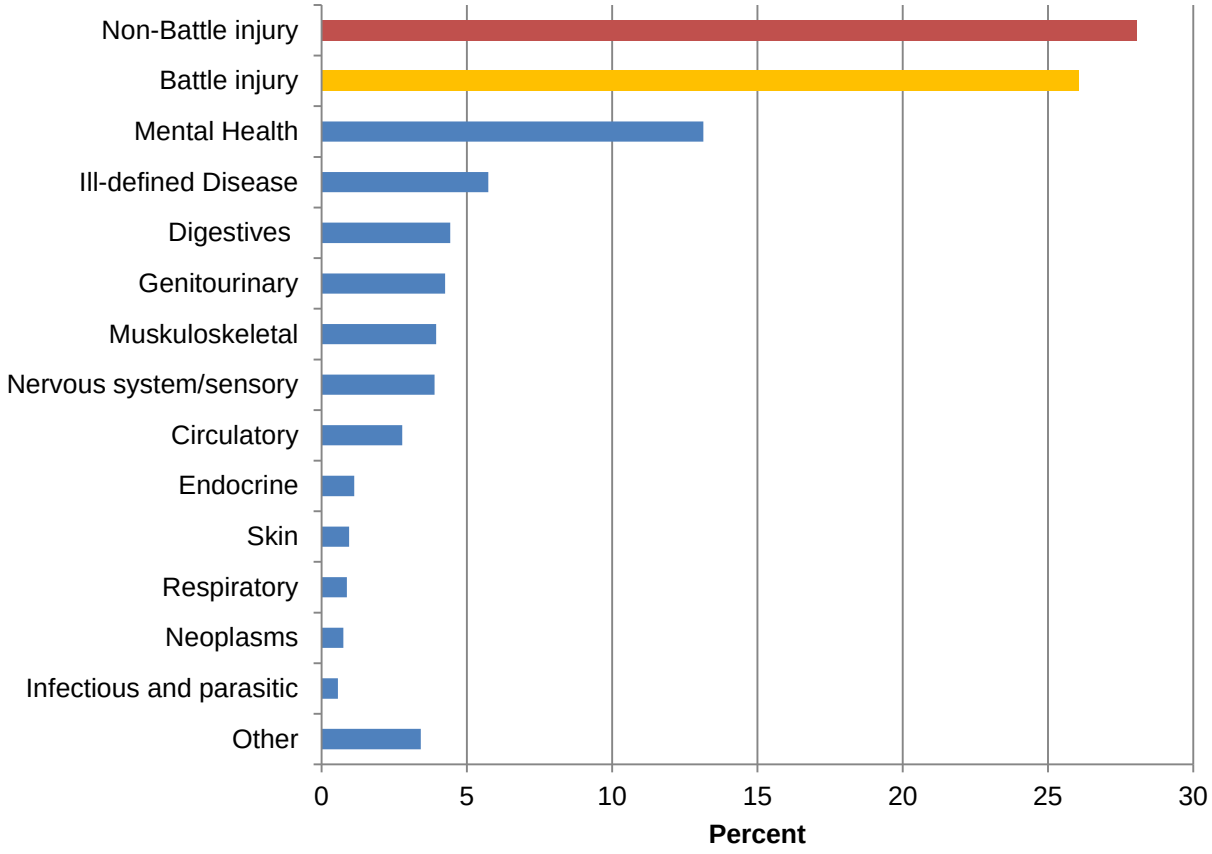
Figure 1. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Air-evacuated U.S. Army Soldiers, OND, CY 2011

(a) In 2011, 1,823 Soldiers in OND were medically air-evacuated to out-of-CENTCOM medical facilities.

(b) NBIs accounted for 28 percent (n=503) of these air evacuations, while the leading disease diagnosis group, mental health, accounted for 18 percent (n=321).

(c) Battle injuries accounted for 5 percent (n=97) of the air evacuations from OND.

(2) Medical air evacuation distribution, OEF. Figure 2 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OEF out-of-CENTCOM medical air evacuations in CY 2011.



Note: Includes injury and disease resulting in out-of-CENTCOM air evacuation for 3,570 Soldiers.

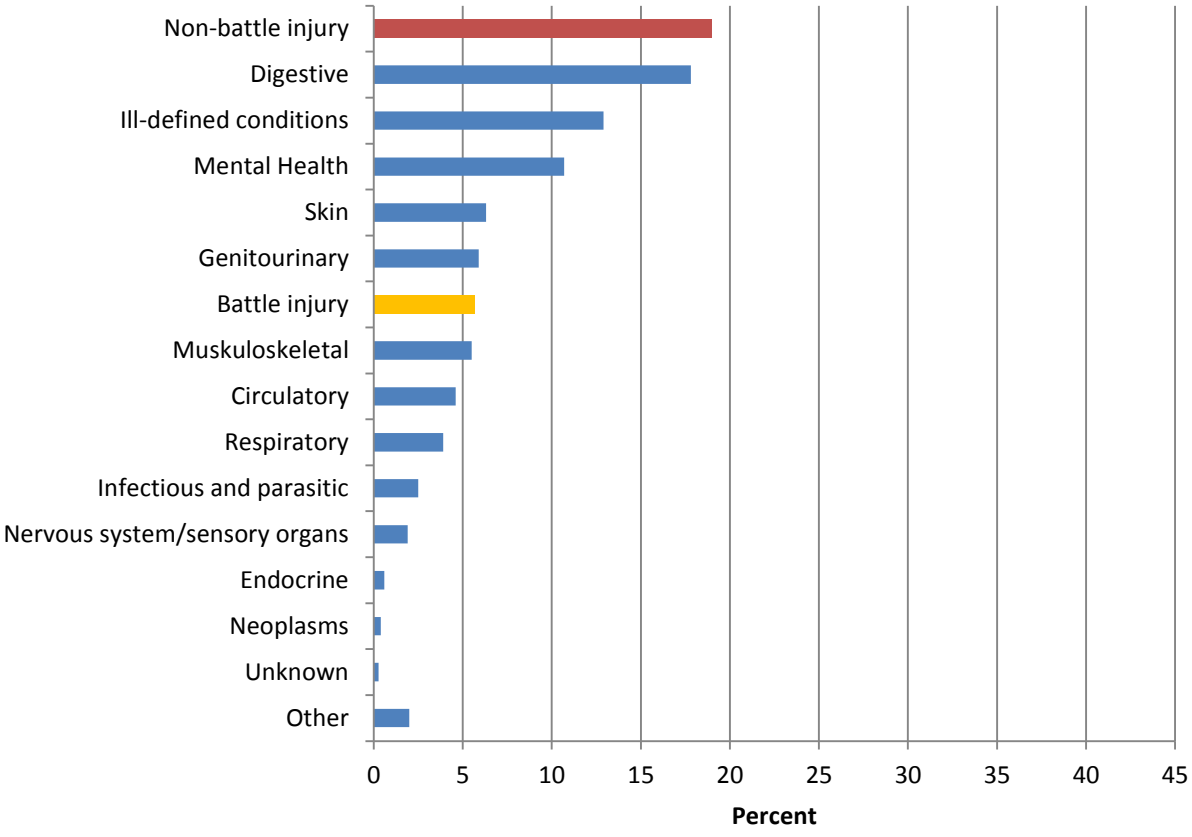
Figure 2. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Air-evacuated U.S. Army Soldiers, OEF, CY 2011

(a) In CY 2011, 3,570 Soldiers were medically air-evacuated from OEF to out-of-CENTCOM medical facilities.

(b) NBIs accounted for 28 percent (n=1,002) of these OEF air evacuations. This amount is two times greater than that of the leading disease diagnosis group, mental health, 13 percent (n=469).

(c) Battle injury (BI) was the second leading category of OEF air evacuations, 26 percent (n=931). More Soldiers with BIs, and a larger proportion of the total ($p<.001$), were air-evacuated from OEF than from OND in CY 2011.

(3) In-theater inpatient hospitalization distribution, OND. Figure 3 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OND in-CENTCOM hospitalizations in CY 2011.



Note: Includes injury and disease resulting in in-CENTCOM hospitalization (N=1,566).

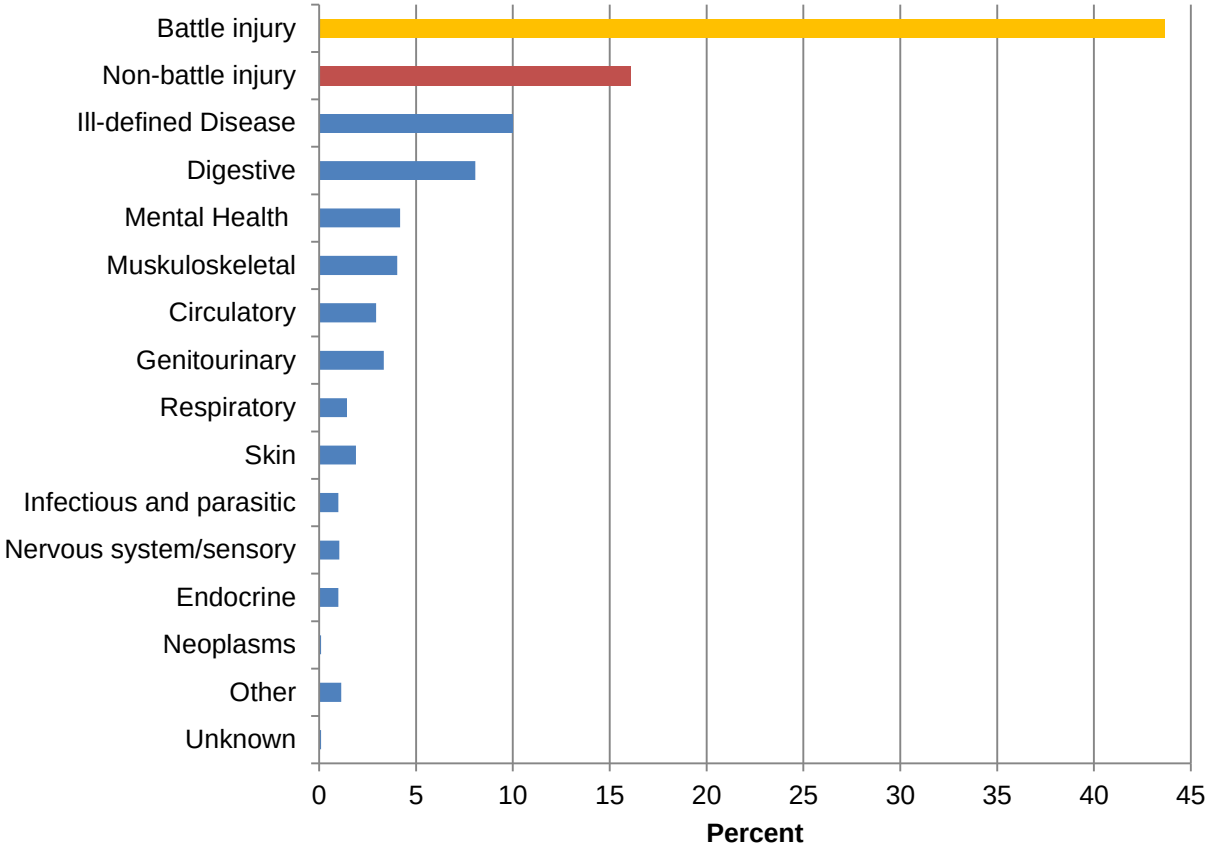
Figure 3. Distribution Percentage (%) of Injury and Disease by Diagnosis

Category among Hospitalized U.S. Army Soldiers, OND, CY 2011

(a) In 2011, 1,566 OND Soldiers were hospitalized within CENTCOM.

(b) NBI was the leading category of OND hospitalizations, 19 percent (n=297). The leading disease diagnosis group was “digestive”, 18 percent (n=278). BIs accounted for 6 percent (n=89) of in-theater hospitalizations.

(4) In-theater inpatient hospitalization distribution, OEF. Figure 4 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OEF in-CENTCOM hospitalizations in CY 2011.



Note: Includes injury and disease resulting in in-CENTCOM hospitalization (N=2,011).

Figure 4. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Hospitalized U.S. Army Soldiers, OEF, CY 2011

(a) In CY 2011, there were 2,011 OEF in-CENTCOM hospitalizations.

(b) The combined BIs (44 percent) and NBIs (16 percent) accounted for 60 percent (n=1,201) of these hospitalizations. The leading specific disease category was “digestive”, 8 percent (n=201).

(c) A significantly greater proportion of BI hospitalizations (p<.001) occurred in OEF than in OND. In contrast, a significantly greater proportion of mental and digestive disease hospitalizations occurred in OND than in OEF (both p<.001). The proportion of NBIs was not significantly different.

(5) Air evacuations, hospitalizations, and deaths, OND. Table 1 summarizes OND deployment injury casualties in CY 2011.

Table 1. Battle Injury and Non-battle Injury[1] among U.S. Army Soldiers Deployed for OND, CY 2011

	Battle Injury		**Non-Battle Injury[2]**	
	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)
Air Evacuations (n=1823)	97	5.3	503	27.6
Hospitalizations (n=1566)	89	5.7	297	19
Deaths (n=50)	35	70	12	24

Notes:
[1]Air evacuation, hospitalization, and death categories are not mutually exclusive
[2]Includes acute injuries and injury-related musculoskeletal conditions

(a) For every 1 deployment NBI death in OND in 2011, there were 24 NBI hospitalizations and 41 NBI medical air evacuations.

(b) Conservatively assuming no overlap among BI air evacuations (n=97), hospitalizations (n=89), and deaths (n=35), at least 44 percent of these BIs (total n=221) resulted in out-of-CENTCOM air evacuations, 40 percent in in-theater hospitalizations, and 16 percent in deaths.

(c) Injury fatalities have been a major focus of injury prevention efforts in the past. However, as shown by these data, there are far more non-fatal injuries that result in medical-air evacuation or hospitalization than there are fatal injuries.

(6) Air evacuations, hospitalizations, and deaths, OEF. Table 2 summarizes OEF deployment injury casualties in CY 2011.

Table 2. Battle Injury and Non-battle Injury[1] among U.S. Army Soldiers Deployed for OEF, CY 2011

	Battle Injury		**Non-Battle Injury[2]**	
	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)
Air Evacuations (n=3570)	931	26.1	1002	28.1
Hospitalizations (n=2011)	878	43.7	323	16.1
Deaths (n=306)	268	87.6	32	10.5

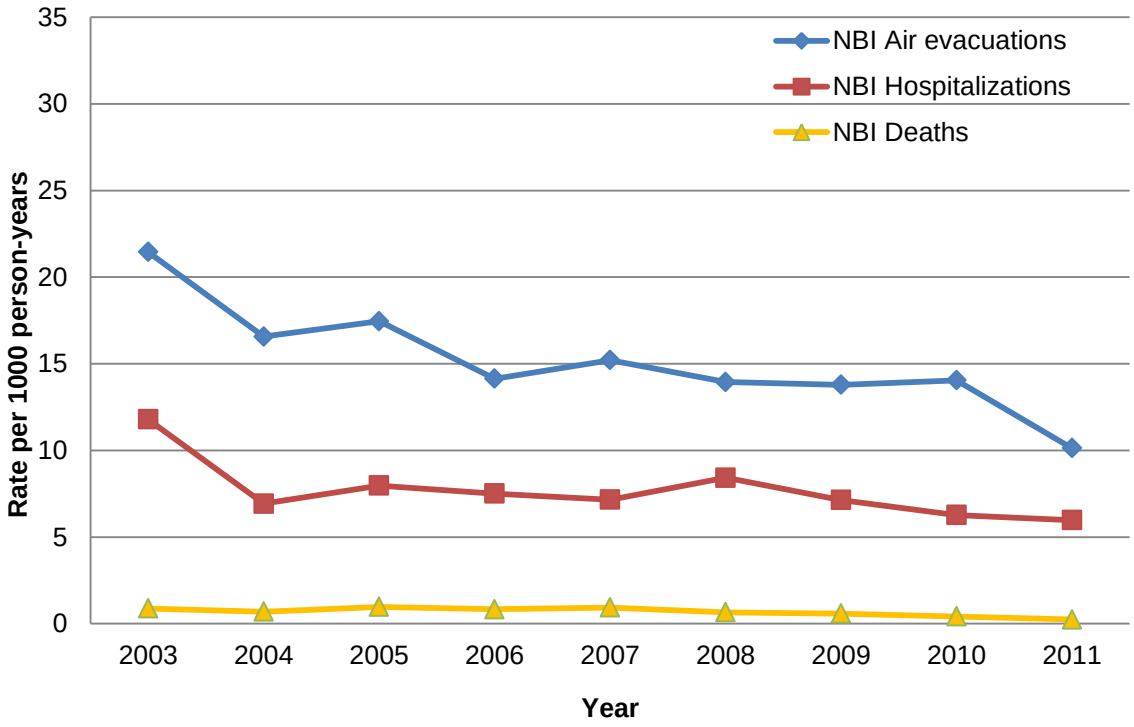
Notes:
[1]Air evacuation, hospitalization, and death categories are not mutually exclusive
[2]Includes acute injuries and injury-related musculoskeletal conditions

(a) For every 1 deployment NBI death in OEF in 2011, there were 10 NBI hospitalizations and 31 NBI medical air evacuations.

(b) Conservatively assuming no overlap among BI air evacuations (n=931), hospitalizations (n=878), and deaths (n=268), at least 44 percent of these BIs (total n=2,097) resulted in out-of-CENTCOM air evacuations, 42 percent in in-theater hospitalization, and 13 percent in death.

(c) These data show that in OEF during CY 2011, there were far more non-fatal injuries that resulted in medical-air evacuation or hospitalization than there were fatal injuries. These non-fatal outcomes result in significant lost duty time and decreased operational readiness for the Army.

(7) NBI rates, OIF/OND. Figure 5 illustrates the OIF/OND NBI rates for air evacuations, hospitalizations, and deaths from 2003 to 2011.



Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

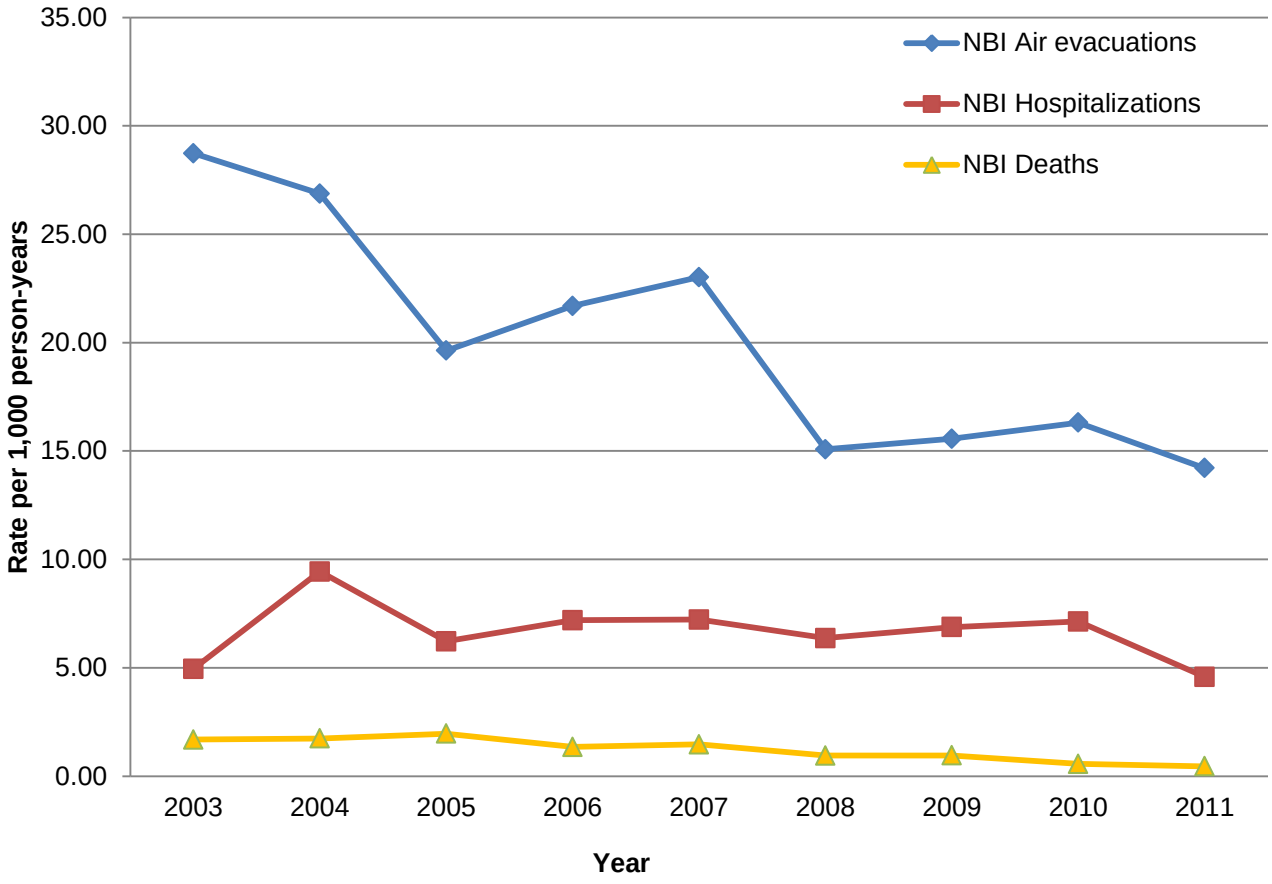
Figure 5. Non-battle Injury Rates among U.S. Army Soldiers Deployed for OIF/OND, CY 2003–2011

(a) During this time period, the OIF/OND NBI air evacuation rates decreased from 22/1,000 person-years to 10/1,000 person-years.

(b) Since 2004, the OIF/OND NBI hospitalization rates remained relatively constant at 7-9/1,000. In CY 2011, the rate fell to 6/1,000 person-years.

(c) The OIF/OND NBI death rates remained constant over the period, consistently less than 1 death per 1,000 person-years.

(8) NBI rates, OEF. Figure 6 illustrates the OEF NBI rates for air evacuations, hospitalizations, and deaths from 2003 to 2011.



Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

Figure 6. Non-battle Injury Rates among U.S. Army Soldiers Deployed for OEF, CY 2003–2011

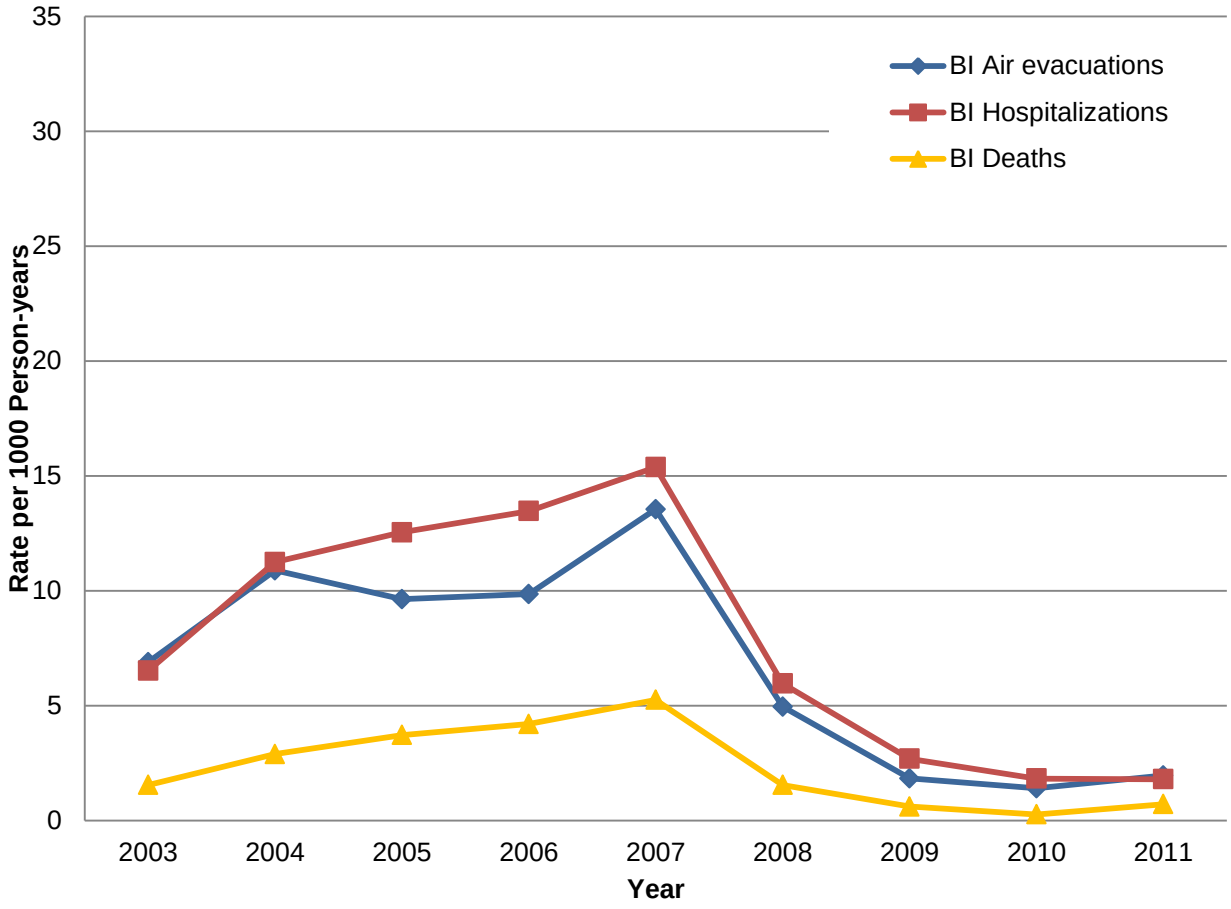
(a) Aside from slight increases in 2006 and 2007, the OEF NBI air evacuation rates decreased from 28/1,000 person-years to 14/1,000 person-years between 2003 and 2011. There was a small decrease from 2010 to 2011.

(b) From 2005 to 2010, the OEF NBI hospitalization rates remained relatively constant at 6 to 7 per 1,000 person-years. However, a slight decrease from 2010 to 2011 was noted.

(c) The OEF NBI death rates remained consistently less than 2 deaths per 1,000 persons per year, showing a decreasing trend since 2005.

(d) Similar trends in air evacuation and hospitalization injury rates are seen in OIF/OND and OEF.

(9) BI rates, OIF/OND. Figure 7 illustrates the OIF/OND BI rates for air evacuations, hospitalizations, and deaths from 2003 to 2011.



Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

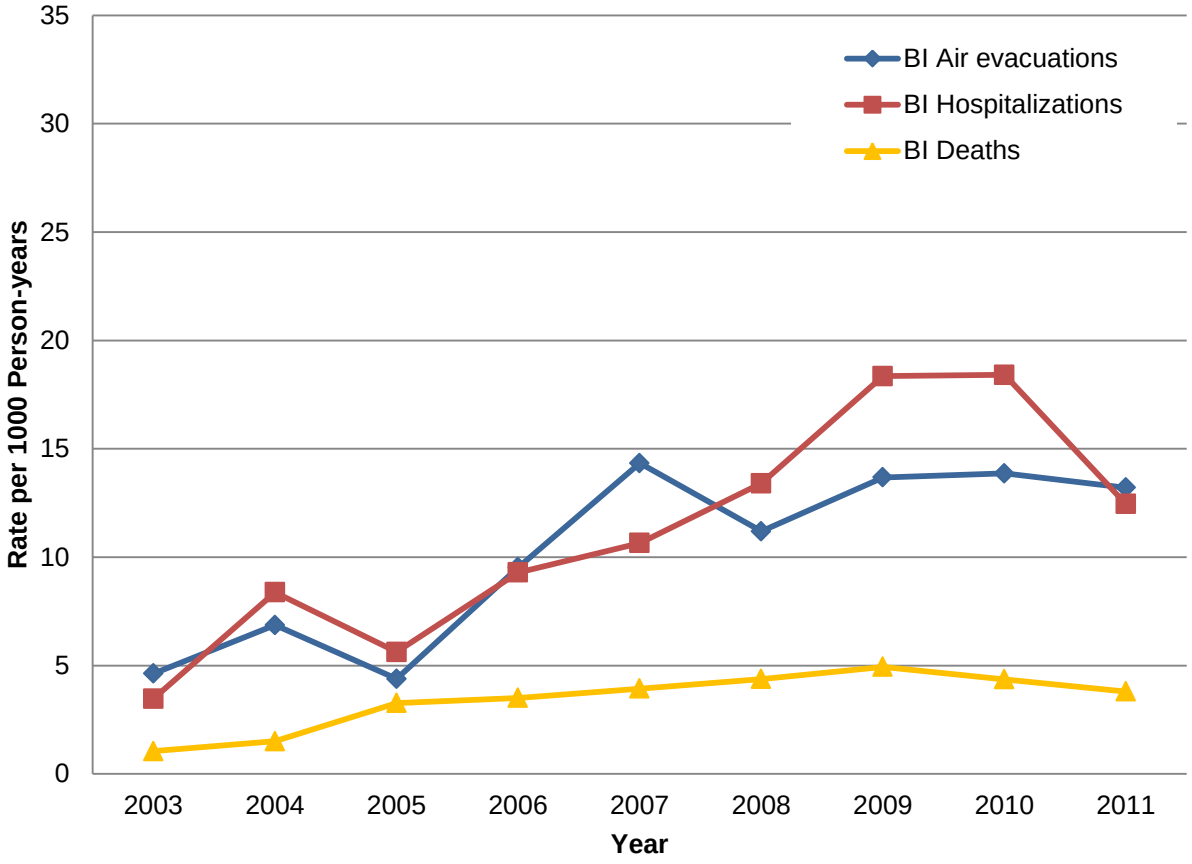
Figure 7. Battle Injury Rates (Air Evacuations, Hospitalizations, and Deaths) among U.S. Army Soldiers Deployed for OIF/OND, CY 2003-2011

(a) The OIF/OND BI air evacuation, hospitalization, and death rates increased from 2003 to 2007 and decreased thereafter.

(b) The OIF/OND BI death rate peaked at 5 deaths per 1,000 persons per year in 2007.

(c) From 2010 to 2011, there was a slight increase for BI air evacuation and death rates while hospitalizations rates continued to decrease.

(10) BI rates, OEF. Figure 8 illustrates the OEF BI rates for air evacuations, hospitalizations, and deaths from 2003 to 2011.



Note: Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

Figure 8. Battle Injury Rates (Air Evacuations, Hospitalizations, and Deaths) among U.S. Army Soldiers Deployed for OEF, CY 2003–2011

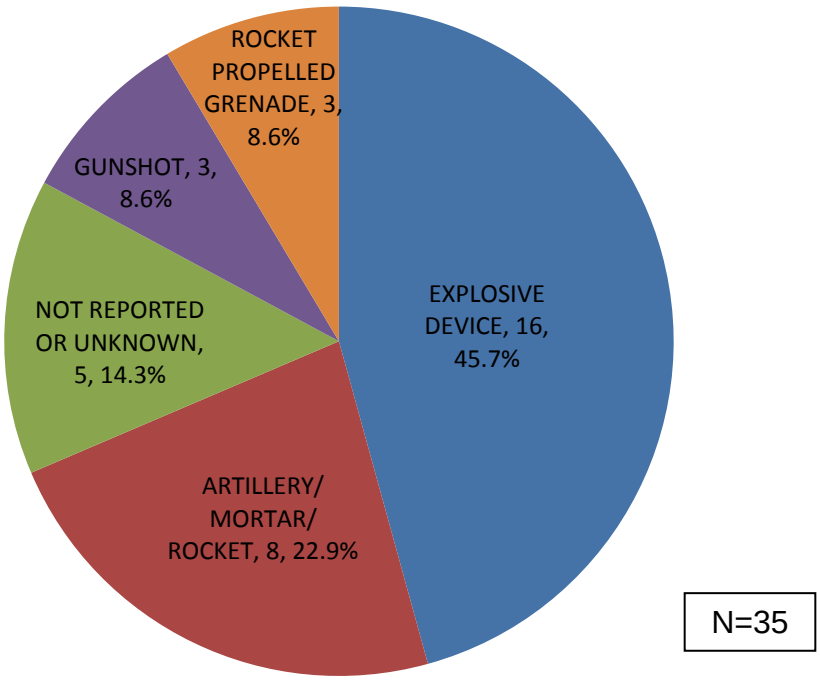
(a) The OEF BI hospitalization rates increased from 2005 to 2009, but greatly decreased from 2010 to 2011.

(b) BI air evacuation and death rates decreased slightly from 2010 to 2011.

(c) Even though BI is shown to have the leading percentage in air evacuation and hospitalization (figure 2 and 4), the rate is still going down compared to previous year 2010 due to an increase in number of deployed Soldiers.

(d) Rates for BI air evacuation and hospitalization were 3 times greater than the death rate in year 2011.

(11) Causes of BI death, OND CY 2011. Figure 9 illustrates the causes of OND Army BI deaths in CY 2011.



Note: Data obtained from Defense Manpower Data Center (DMDC).

Figure 9. Distribution of Causes of Battle Injury Deaths (n, percent) among U.S. Army Soldiers Deployed for OND, CY 2011

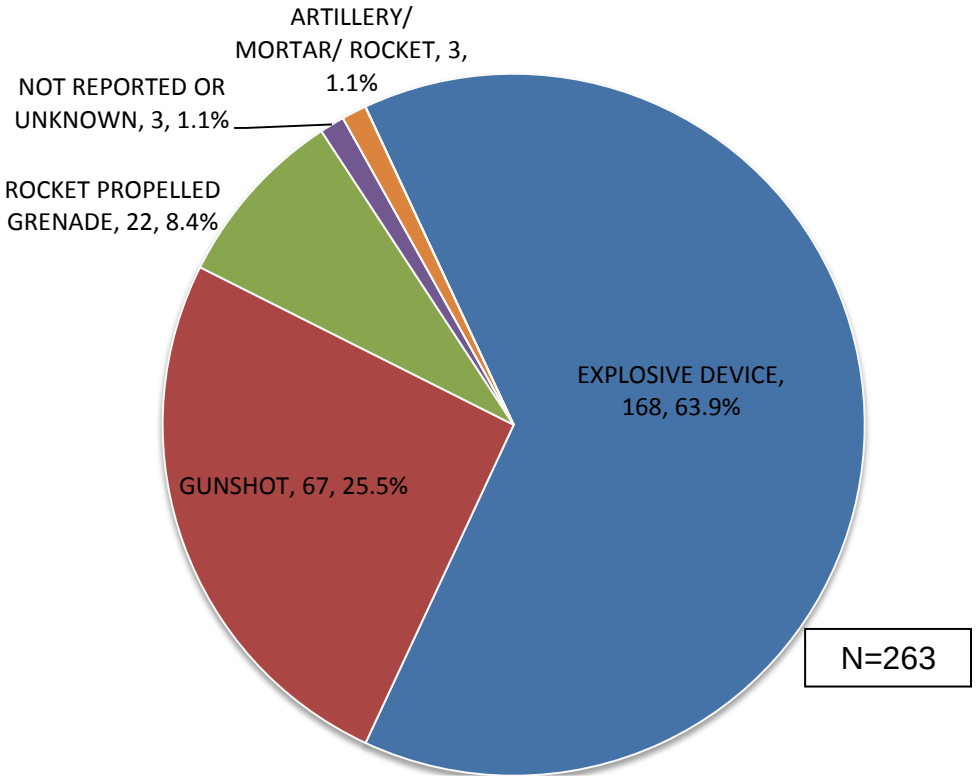
(a) Forty-six percent of battle fatalities were due to explosive devices.

(b) Twenty-three percent of battle fatalities were due to artillery, mortar, or rockets.

(c) Nine percent of battle fatalities were due to rocket-propelled grenades.

(d) Nine percent of battle fatalities were due to small arms fire.

(12) Causes of BI death, OEF CY 2011. Figure 10 illustrates the causes of OEF Army BI deaths in CY 2011.



Note: Data obtained from Defense Manpower Data Center (DMDC).

Figure 10. Distribution of Causes of Battle Injury Deaths (n, percent) among U.S. Army Soldiers Deployed for OEF, CY 2011

(a) Sixty-four percent of battle fatalities were due to explosive devices.

(b) Twenty-six percent of battle fatalities were due to small arms fire.

(c) Eight percent of battle fatalities were due to rocket-propelled grenades.

(d) One percent of battle fatalities were due to artillery, mortar, or rockets.

(13) Injury intention for NBI hospitalizations, air evacuations, and deaths, OND and OEF, CY 2011. Table 3 provides a summary of CY 2011 OND and OEF NBIs by injury intention.

Table 3. Injury Intention for Non-battle Injuries, OND and OEF, CY 2011

	OND						OEF					
Injury Intention	Air Evacuations		Hospitalizations		Deaths		Air Evacuations		Hospitalizations		Deaths	
	n	%	n	%	n	%	n	%	n	%	n	%
Intentional												
Inflicted by another	10	1.9	5	1.7	1	7.7	11	1.0	3	0.9	1	2.9
Self-inflicted	0	0	14	4.7	9	69.2	1	0.1	19	5.9	14	41.2
Unintentional	510	94.6	272	91.9	2	15.4	1028	95.3	298	92.3	17	50
Unknown	19	3.5	5	1.7	1	7.7	39	3.6	3	.9	2	5.9
TOTAL	**539**	**100.0**	**296**	**100**	**13**	**100.0**	**1079**	**100.0**	**323**	**100**	**34**	**100.0**

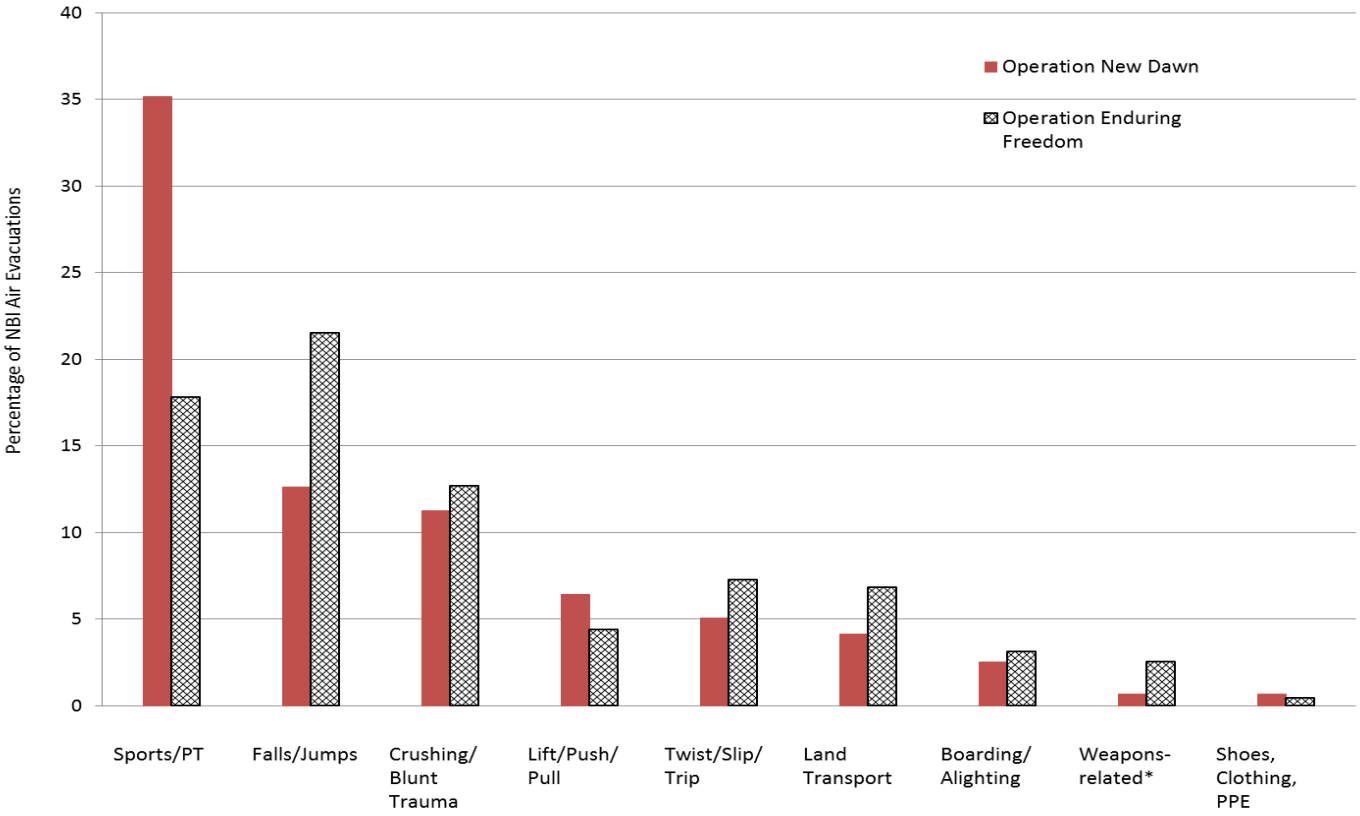
Note: Intention of injury was determined by the STANAG 2050 trauma code.

(a) The majority of NBI hospitalizations and air evacuations resulted from unintentional injuries. Unintentional NBIs accounted for the largest proportion of NBI deaths.

(b) Of the self-inflicted NBIs resulting in death (n=23), 91 percent were the result of a weapon-related incident.

(c) Of the self-inflicted NBIs resulting in hospitalization (n=33), 76 percent were caused by inhalation or ingestion of toxic substances, 12 percent were cutting-related incidents, 6 percent were weapon-related incidents, and 3 percent resulted from other specified causes.

(14) Causes of NBI air evacuations. Figure 11 illustrates the distribution of the leading NBI causes of air evacuation, categorized by STANAG 2050 injury cause code groups.



Notes:
[1]Proportion of total 2011 deployment NBI air evacuations with a known cause for each operation (OND: N=435; OEF: N=865).
* "Weapons-related" injuries were referred to as "own weapon" and "handling weapons/explosives" in previous reports.

Figure 11. Distribution of Leading Causes[1] of Non-battle Injury Air Evacuations among U.S. Army Soldiers Deployed for OND and OEF, CY 2011

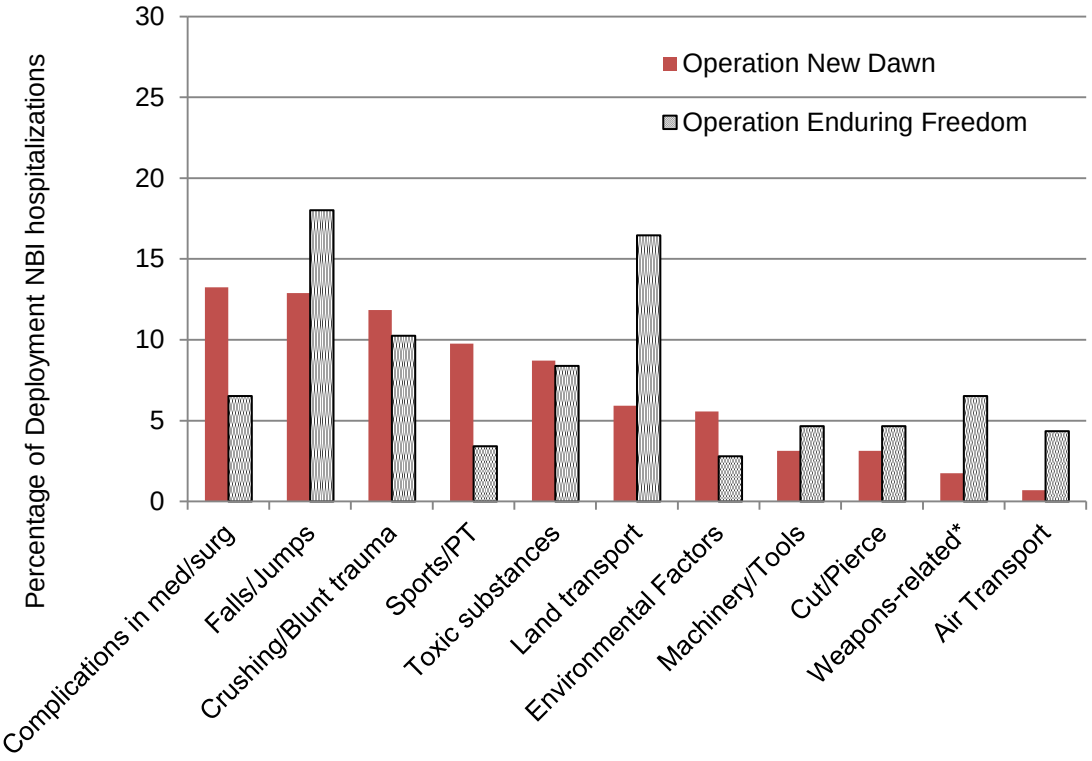
(a) In 2011, the cause of injury was identified for 1,300 of the NBIs reported for OND and OEF air evacuations (86 percent of the total NBI air evacuations).

(b) The four leading causes of NBI air evacuations for OND were sports/physical training, falls/jumps, crushing/blunt trauma, and lift/push/pull.

(c) The four leading causes of NBI air evacuations for OEF were falls/jumps, sports/physical training, crushing/blunt trauma, and twist/slip/trip.

(d) For OND and OEF combined, the leading causes of sports-related NBIs were weightlifting (24 percent), basketball (23 percent), physical training (18 percent), and football (12 percent). (These data are not shown in the figure.)

(15) Causes for NBI hospitalizations. Figure 12 illustrates the distribution of the leading NBI causes for hospitalization, categorized by STANAG 2050 injury causes code groups.



Notes:
[1]Proportion of total 2011 deployment NBI hospitalizations for each operation (OND: N=220; OEF: N=279).
* "Weapons-related" injuries were referred to as "own weapon" and "handling weapons/explosives" in previous reports.

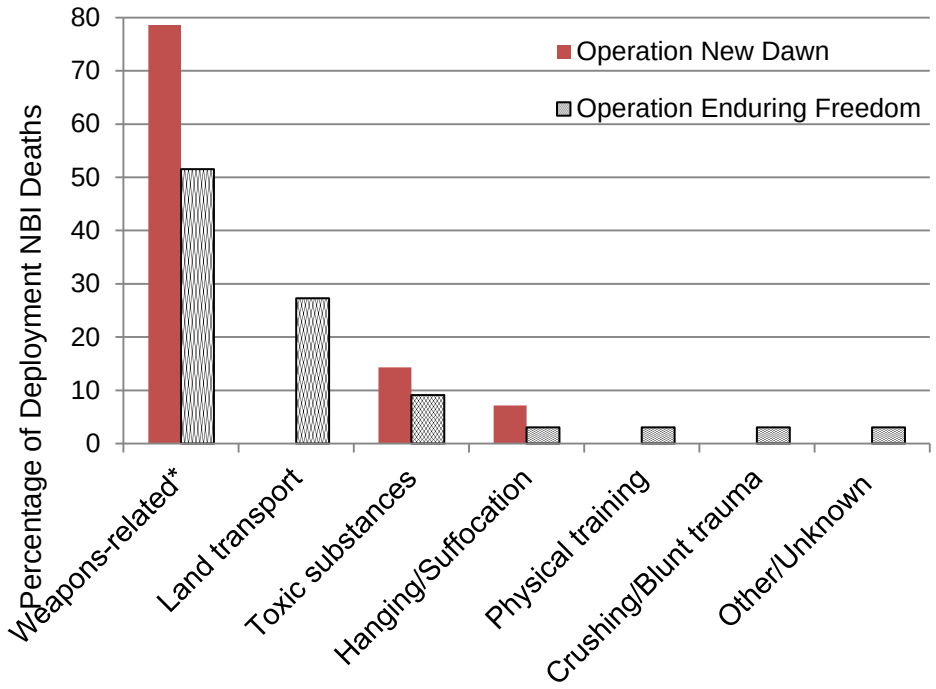
Figure 12. Distribution of Leading Causes of Non-battle Injury Hospitalizations among U.S. Army Soldiers Deployed for OND and OEF, CY 2011

(a) The three leading causes of NBI hospitalization for OND were complications in medical procedures/surgeries (13 percent), falls/jumps (13 percent), and crushing/blunt trauma (12 percent) (no additional information was available on these leading causes).

(b) The three leading causes for OEF were falls/jumps (18 percent), land transport (17 percent), and crushing/blunt trauma (10 percent).

(c) The causes of hospitalization that differed in percentage between OND and OEF were land transport ($p<.01$) and complications in medical procedures/surgery ($p<.01$).

(16) Causes of NBI deaths. Figure 13 illustrates the distribution of the leading NBI causes of death, categorized by STANAG 2050 injury causes code groups as a proportion of total NBI deaths.



Notes:
[1]Deaths for cause of injury coding were obtained from DCIPS (OND: N=14; OEF: N=33).
[2]Deaths include both intentional and unintentional non-battle injuries.
* "Weapons-related" injuries were referred to as "own weapon" (i.e., intentional) and "handling weapons/explosives" (i.e. unintentional) in previous reports.

Figure 13. Distribution of Leading Causes of Non-battle Injury Deaths[1] among U.S. Army Soldiers Deployed for OND and OEF, CY 2011

(a) The top three causes of death for OND were weapons-related (n=11), inhalation or ingestion of toxic substances (n=2), and hanging/suffocation (n=1). The three leading causes for OEF were weapons-related (n=17), land transport (n=9), and toxic substances (n=3).

(b) “Weapons-related” injury was the leading cause of NBI deaths for OND and OEF. For OND and OEF combined, 75 percent of “weapons-related” deaths were intentionally self-inflicted (n=21), 14 percent were intentionally inflicted by another (n=4), and 11 percent (n=3) were accidental.

(c) Compared to year 2010, air transport fatalities has dropped to 0 from 20 percent in OND and 9 percent in OEF (not shown in graph).

(17) Frequency of NBI air evacuations by type and location of injury. Table 4 uses the Barell injury matrix to categorize, by type of injury and body region, the traumatic NBIs that required medical air evacuation from OND and OEF in CY 2011.

Table 4. Frequency of Air-evacuated Traumatic Non-battle Injuries by Type and Location of Injury, U.S. Army, OND and OEF, CY 2011

			Fracture	Dislocation	Sprains/ Strains	Internal	Open Wound	Amputations	Blood Vessel	Contusion/Superficial	Crush	Burns	Nerves	Unspecified	System-wide & late effects	Total	Percent	Percent by Body Region
Head and Neck	Traumatic Brain Injury (TBI)	Type 1 TBI	0			17							0			17	2.0	5.0
		Type 2 TBI	5			21										26	3.0	
		Type 3 TBI	0													0	0.0	
	Other Head, Face, Neck	Other head					1					0	0	3		4	0.5	5.3
		Face	24	0	0		4					3				31	3.6	
		Eye					5			1		0	0			6	0.7	
		Neck	0		0		1				0	2	0			3	0.3	
		Head, Face, Neck Unspec.							1	0	0	1	0	0		2	0.2	
Spine and Back	Spinal Cord (SCI)	Cervical SCI	1			0										1	0.1	0.5
		Thoracic/Dorsal SCI	0			0										0	0.0	
		Lumbar SCI	0			1										1	0.1	
		Sacrum Coccyx SCI	0			0										0	0.0	
		Spine, Back Unspec. SCI	1			1										2	0.2	
	Vertebral Column (VCI)	Cervical VCI	11	1	4											16	1.8	3.2
		Thoracic/Dorsal VCI	2	1	0											3	0.3	
		Lumbar VCI	6	1	1											8	0.9	
		Sacrum Coccyx VCI	0	0	0											0	0.0	
		Spine, Back Unspec. VCI	1	0												1	0.1	
Torso	Torso	Chest (thorax)	3	1	1	4	0		0	1	0	0	0			10	1.2	3.3
		Abdomen				1	1		1	0		0	0			3	0.3	
		Pelvis, Urogenital	4	0	2	0	2		0	0	1	0	0			9	1.0	
		Trunk	0				0			0	0	0	0	2		2	0.2	
		Back, Buttock			3		1			1	0	0				5	0.6	
Extremities	Upper	Shoulder, Upper Arm	24	43	40		1	0		1	0	0		1		110	12.7	40.1
		Forearm, Elbow	38	9	2		2	1		2	0	0				54	6.2	
		Wrist, Hand, Fingers	108	13	5		21	12		1	3	1		4		168	19.4	
		Other & Unspec.	0				0	0	2	1	0	2	11	0		16	1.8	
	Lower	Hip	6	2	2					1	0					11	1.3	35.1
		Upper leg, Thigh	7					0		1	0	0				8	0.9	
		Knee	6	68	21					1	0	1				97	11.2	
		Lower leg, Ankle	94	1	15			0		0	0	0				110	12.7	
		Foot, toes	37	2	2		5	1		4	2	0				53	6.1	
		Other & Unspec.	1		11		7	0	0	0	0	1		5		25	2.9	
Unclass. by Site	Other, Unspecified	Other/Multiple	0						0			1	0			1	0.1	4.5
		Unspec. Site	17	2	7	0	0		0	2	1	3	5	1		38	4.4	
	System-wide & late effects														26	26	3.0	3.0
		Total	396	144	116	45	51	14	4	17	7	15	16	16	26	867		
		Percent	45.7	16.6	13.4	5.2	5.9	1.6	0.5	2.0	0.8	1.7	1.8	1.8	3.0		100.0	100.0

Note: ICD-9-CM 800-995 codes. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

(a) In 2011, 867 acute/traumatic NBIs (coded in the 800-995 ICD-9-CM code series) required medical air evacuation.

(b) The most common types of injury leading to medical air evacuation were fractures (46 percent), dislocations (17 percent), and sprains/strains (13 percent).

(c) By body region, the injury sites most commonly leading to medical air evacuation were the upper extremities (40 percent), lower extremities (35 percent), and head, face, and neck (5 percent).

(d) The leading specific reasons for medical air evacuation included fractures of the wrist, hand, or fingers (19 percent), fractures of the lower leg and/or ankle (13 percent), strain/sprain of the shoulder/upper arm (13 percent), and dislocation of the knee (11 percent).

(18) Frequency of non-battle injury-related musculoskeletal condition air evacuations by type and location of injury. Table 5 categorizes, by type of injury and body region, the NBI-related musculoskeletal conditions (a subset of musculoskeletal conditions coded in the 719-739 ICD-9-CM series) that required medical air evacuation from OND and OEF in CY 2011.

Table 5. Frequency of Air-evacuated Non-battle Injury-related Musculoskeletal Conditions by Type and Location of Injury, U.S. Army, OND and OEF, CY 2011

			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological	Stress Fracture	Sprains/Strains/ Rupture	Dislocation	Total	Percent	Percent by Body Region
Spine and Back	Vertebral Column (VCI)	Cervical VCI	33	4	5				42	9.2	47.9
		Thoracic/Dorsal VCI		0	17				17	3.7	
		Lumbar VCI	112	16	9				137	29.8	
		Sacrum Coccyx VCI	0						0	0.0	
		Spine, Back Unspec. VCI	9	6	9	0			24	5.2	
Extremities	Upper	Shoulder	52	2			13	3	70	15.3	18.3
		Upper Arm, Elbow	1	0		0		0	1	0.2	
		Forearm, Wrist	8	0		0		0	8	1.7	
		Hand	3	0			2	0	5	1.1	
	Lower	Pelvis, Hip, Thigh	11	0		1	1	0	13	2.8	25.3
		Lower leg, Knee	16	38		0	35	0	89	19.4	
		Ankle, Foot	10	2		1	1	0	14	3.1	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	2	0		0	2	0	4	0.9	8.5
		Unspecified Site	13	1	6	7	8	0	35	7.6	
		Total	270	69	46	9	62	3	459		
		Percent	58.8	15.0	10.0	2.0	13.5	0.7		100.0	100.0

Note: ICD-9-CM 710-739 codes. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

(a) In 2011, 459 NBI-related musculoskeletal conditions required medical air evacuation.

(b) The most common types of musculoskeletal conditions leading to medical air evacuation were inflammation and pain (overuse) (59 percent), joint derangement (15 percent), sprain/strain/rupture of muscle or tendons (14 percent), and joint derangement with neurological involvement (10 percent).

(c) At 48 percent, the spine/back was the body region most affected by injury-related musculoskeletal conditions, followed by the lower extremities (25 percent), and upper extremities (18 percent).

(d) The leading specific injury-related musculoskeletal conditions were inflammation and pain (overuse) in the lumbar (24 percent), inflammation and pain (overuse) in the shoulder (11 percent), and joint derangement in the lower leg, knee (8 percent).

(19) Frequency of NBI hospitalizations by type and location of injury. Table 6 uses the Barrel injury matrix to categorize, by type of injury and body region, the traumatic NBIs that required in-theater hospitalization in OND and OEF in CY 2011.

Table 6. Frequency of Traumatic Hospitalized Non-battle Injuries by Type and Location of Injury, U.S. Army, OND and OEF, CY 2011

			Fracture	Dislocation	Sprains/ Strains	Internal	Open Wound	Amputations	Blood Vessel	Contusion/Superficial	Crush	Burns	Nerves	Unspecified	System-wide & late effects	Total	Percent	Percent by Body Region
Head and Neck	Traumatic Brain Injury (TBI)	Type 1 TBI	7			30							0			37	6.8	14.1
		Type 2 TBI	3			35										38	6.9	
		Type 3 TBI	2													2	0.4	
	Other Head, Face, Neck	Other head					2					0	0	4		6	1.1	9.3
		Face	23	0	0		8					1				32	5.9	
		Eye					1			2		0	0			3	0.5	
		Neck	0		0		0				0	1	0			1	0.2	
		Head, Face, Neck Unspec.							0	7	0	0	0	2		9	1.6	
Spine and Back	Spinal Cord (SCI)	Cervical SCI	2			1										3	0.5	1.1
		Thoracic/Dorsal SCI	0			1										1	0.2	
		Lumbar SCI	1			0										1	0.2	
		Sacrum Coccyx SCI	0			0										0	0.0	
		Spine, Back Unspec. SCI	0			1										1	0.2	
	Vertebral Column (VCI)	Cervical VCI	5	0	4											9	1.6	3.5
		Thoracic/Dorsal VCI	3	0	1											4	0.7	
		Lumbar VCI	2	0	4											6	1.1	
		Sacrum Coccyx VCI	0	0	0											0	0.0	
		Spine, Back Unspec. VCI	0	0												0	0.0	
Torso	Torso	Chest (thorax)	8	0	0	6	0		0	1	4	0	0			19	3.5	8.2
		Abdomen				10	1		0	1		0	0			12	2.2	
		Pelvis, Urogenital	1	0	0	2	1		0	3	0	0	0			7	1.3	
		Trunk	0				0			1	0	0	0	4		5	0.9	
		Back, Buttock			0		0			1	0	1				2	0.4	
Extremities	Upper	Shoulder, Upper Arm	8	2	2		1	0		1	1	0		0		15	2.7	26.3
		Forearm, Elbow	13	1	0		4	0		1	2	4				25	4.6	
		Wrist, Hand, Fingers	44	1	0		19	10		1	25	0		0		100	18.3	
		Other & Unspec.	0				0	0	1	0	0	0	3	0		4	0.7	
	Lower	Hip	3	1	2					1	0					7	1.3	20.3
		Upper leg, Thigh	2					0		1	0	0				3	0.5	
		Knee	2	9	1					0	2	0				14	2.6	
		Lower leg, Ankle	34	4	12			0		0	1	1				52	9.5	
		Foot, toes	9	2	0		4	1		0	3	0				19	3.5	
		Other & Unspec.	0		3		12	0	0	0	0	0		1		16	2.9	
Unclass. by Site	Other, Unspecified	Other/Multiple	0						0			0	0			0	0.0	1.1
		Unspec. Site	0	0	2	0	0		0	1	0	0	1	2		6	1.1	
System-wide & late effects															88	88	16.1	16.1
		Total	172	20	31	86	53	11	1	22	38	8	4	13	88	547		
		Percent	31.4	3.7	5.7	15.7	9.7	2.0	0.2	4.0	6.9	1.5	0.7	2.4	16.1		100.0	100.0

Note: ICD-9-CM 800-995 codes. Includes the first listed injury diagnosis for injuries resulting in in-CENTCOM hospitalization.

(a) In 2011, 547 NBIs (coded in the 800-995 ICD-9-CM code series) required in-theater hospitalization.

(b) The most common types of injury leading to in-theater hospitalization were fractures (31 percent), system wide and late effects (16 percent), and internal injuries (16 percent).

(c) The injured body regions most commonly leading to in-theater hospitalization were upper extremities (26 percent), lower extremities (20 percent), and traumatic brain injury (14 percent).

(d) The leading specific reasons for in-theater hospitalization included fractures of the wrist, hand, and/or fingers (18 percent), fractures of the lower leg and/or ankle (10 percent), and internal Type 2 traumatic brain injuries (7 percent).

(20) Frequency of non-battle musculoskeletal injury hospitalizations by type and location of injury. Table 7 categorizes, by type of injury and body region, the NBI-related musculoskeletal conditions (a subset of musculoskeletal conditions coded in the 719-739 ICD-9-CM series) that required in-theater hospitalization in OND and OEF in CY 2011.

Table 7. Frequency of Hospitalized Non-battle Injury-related Musculoskeletal Conditions by Type and Location of Injury, U.S. Army, OND and OEF, CY 2011

			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological	Stress Fracture	Sprains/Strains/ Rupture	Dislocation	Total	Percent	Percent by Body Region
Spine and Back	Vertebral Column (VCI)	Cervical VCI	26	0	0				26	22.2	68.4
		Thoracic/Dorsal VCI		0	3				3	2.6	
		Lumbar VCI	29	9	2				40	34.2	
		Sacrum Coccyx VCI	0						0	0.0	
		Spine, Back Unspec. VCI	11	0	0	0			11	9.4	
Extremities	Upper	Shoulder	4	0			0	0	4	3.4	10.3
		Upper Arm, Elbow	6	1		0		0	7	6.0	
		Forearm, Wrist	0	0		0		0	0	0.0	
		Hand	0	0			1	0	1	0.9	
	Lower	Pelvis, Hip, Thigh	1	0		2	0	0	3	2.6	14.5
		Lower leg, Knee	7	4		0	3	0	14	12.0	
		Ankle, Foot	0	0		0	0	0	0	0.0	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	1	0		0	1	0	2	1.7	6.8
		Unspecified Site	6	0	0	0	0	0	6	5.1	
		Total	91	14	5	2	5	0	117		
		Percent	77.8	12.0	4.3	1.7	4.3	0.0		100.0	100.0

Note: ICD-9-CM 710-739 codes. Includes the first listed injury diagnosis for injuries resulting in in-CENTCOM hospitalization.

(a) In 2011, 117 NBI-related musculoskeletal conditions required in-theater hospitalization.

(b) The most common types of musculoskeletal conditions leading to in-theater hospitalization were inflammation and pain (overuse) (78 percent), joint derangement (12 percent), and joint derangement with neurological involvement (4 percent).

(c) At 68 percent, the spine/back was the body region most affected by injury-related musculoskeletal conditions, followed by the lower extremities (15 percent), and upper extremities (10 percent).

(d) The leading specific injury-related musculoskeletal conditions were inflammation and pain (overuse) to the lumbar spine (25 percent), inflammation and pain (overuse) involving the cervical spine (22 percent), and inflammation and pain (overuse) to the spine, back unspecified (9 percent).

d. Discussion.

(1) In CY 2011, NBI was the largest single diagnosis category that resulted in out-of-CENTCOM air evacuations for OND and OEF. NBI was the leading diagnosis category for OND hospitalizations and second to BIs for OEF hospitalizations. The present findings are consistent with previous studies showing the relative importance of NBIs as a cause of morbidity and mortality.[1-11]

(a) In the CY 2010 deployment injury surveillance report for OIF/OND and OEF, there were nearly 6 times more disease and non-battle injuries (DNBIs), combined, than BIs, and 32 percent of air evacuations were for NBIs.

(b) For OND in CY 2011, there were 17 times more DNBIs than BIs, and 28 percent of air evacuations were from NBIs. NBIs remained the leading cause of OIF/OND air evacuations, while BIs fell from the fourth leading cause in CY 2009 to the seventh leading cause in CY 2011.

(c) For OEF in CY 2011, there were almost three times as many DNBIs as BIs, and 29 percent of air evacuations were for NBIs.

(d) The proportion of NBIs for OIF/OND hospitalizations increased from 2010 making it the leading cause of OND hospitalizations. This is understandable given that the operations in Iraq changed focus with the transition from OIF to OND. Battle injuries moved up one place from the eighth to the seventh leading cause of hospitalizations in-theater.

(2) The annual NBI air evacuation rates for OIF/OND decreased over time from a high in 2003. The annual NBI hospitalization rates for OIF/OND decreased from 2003 to 2004 and have remained relatively constant since that time. The annual NBI death rate for OIF/OND has slightly decreased overtime from 2003. Operation Enduring Freedom has experienced greater fluctuation in the NBI rates of air evacuation and hospitalization than OIF/OND, with 2004 and 2007 being peak years. Injury rates and trends for OIF/OND and OEF were previously reported by other descriptive studies.[16,17-18] These studies showed peak rates in 2003 but did not include the 2007 time period which represented the "surge" in OIF.

(3) In this report, the leading NBI types for 2011 air evacuations were fracture, dislocations, sprains/strains, and inflammation and pain (overuse). Majority of the fractures were due to falls, crushing/blunt trauma, and sport injuries. The back was most commonly involved, followed by upper extremities. In general, previous studies have focused on specific body regions or diagnosis categories when describing injury or disease type. As noted in the 2009 report, the finding of fractures as the leading NBI types for both hospitalizations and air evacuations was consistent with the burden of non-battle orthopedic injuries treated at one facility during the combat phase of OIF.[19]

(4) The U.S. Army uses surveillance data to identify cause of injury and potentially modifiable risk factors for injury to develop comprehensive injury prevention programs. Overall, the rates of NBI injuries are decreasing (figure 5 and 6). This report has identified the top three causes of NBI air evacuations in 2011 as sports/physical training, falls/jumps, and crushing/blunt trauma. The top three leading causes of NBI hospitalizations, which differed a little from those of NBI air evacuations, were falls/jumps, land transport-related accidents, and crushing/blunt trauma. The leading causes of death were weapons-related incidents (gunshot wounds), land transport-related accidents, and toxic substances. Self-inflicted injury fatalities, which rose from 2004 to 2008,[20] accounted for nearly all weapons-related NBI fatalities ("own weapon").

(5) The impact of injuries and the causes, type, and body region of injuries were similar from 2010 to 2011, with minor changes. In CY 2010, compared to 2011:

(a) Operation Iraqi Freedom/Operation New Dawn experienced a slightly higher rate of BI air evacuations and hospitalizations compared to year 2010 (figure 7).

(b) In Operation Iraqi Freedom/Operation New Dawn, NBI rates for air evacuations, hospitalizations, and fatalities decreased from 2010 to 2011 (figure 5). The rate for air evacuated NBIs had the greatest change, going from 14 to 10 per 1,000 person-years. In Operation Enduring Freedom, BI rates for air evacuations,

hospitalizations, and fatalities decreased from 2010 to 2011. The hospitalization rate had the greatest change, going from 18 to 12 per 1,000 person-years (figure 8).

(c) The leading causes of OEF battle-related deaths were similar compared to the previous year but there was a decrease in the rate. However, the leading causes of BI deaths in OIF/OND changed from 2010 to 2011. The proportion of BI deaths caused by gunshot wounds increased from 5% in 2010 to 9% in 2011. The proportion of BI deaths from artillery, mortar, or rockets increased from 21% in 2010 to 23% in 2011.

(d) The leading body sites for injury differed only slightly for 2011 as compared to 2010. In 2010, the leading body injury sites for NBIs, in order of high to low, were the back, knee, ankle/foot, shoulder, and wrist/hand. In 2011, these sites were the back, wrist/hand, knee, ankle/foot, and shoulder.

(e) In OIF/OND, sports/PT and falls/jumps were the two leading causes of air evacuated NBIs in 2010 and 2011. But in 2011, crushing/blunt trauma replaced land transport accidents as the third leading cause of air evacuated NBIs. In OEF, falls/jumps replaced sports/PT as the leading cause of air evacuated NBIs.

(f) In 2011, the top three leading causes of NBI hospitalizations did not remain the same; falls/jump injuries increased while land transport stayed consistent compared to 2010. The increase in the percentage of toxic substance hospitalizations out of all hospitalizations could be associated with the increase in self-inflicted toxic substance (poisoning) hospitalizations from 2010 (30 percent) to 2011 (46 percent).

(g) Unlike year 2010, there were no air transport non-battle fatalities for either OEF or OIF/OND in 2011. Also there are no fatalities this year from land transport in OND. An increase in weapons-related NBI deaths in OIF and OEF was noted.

(h) The proportion of air evacuated and hospitalized NBIs caused by Sports/PT was smaller in OEF than OIF/OND air evacuations and hospitalizations were both lower in OEF compared to OIF/OND.

(6) Current intervention studies and strategies (civilian and military) to address deployment NBI include:

(a) Vehicle rollover drowning prevention training, rollover simulator training, equipment modifications to prevent rollover accidents, and improved compliance for seatbelt use. [21-23]

(b) Ocular preventive measures such as hygiene, contact lens restriction, and protective eyewear use during participation in racquet and contact sports.[24-27]

(c) Use of ankle braces (stabilizers) to reduce ankle injuries while engaging sports and physical training. [28-30]

(d) Breakaway bases, recessed bases, and proper sliding technique education for softball and baseball sliding injuries.[31]

(e) Mouthguard use in sports activities where there is significant risk of orofacial injury.[32]

e. Recommendations.

(1) Continue routine surveillance of deployment injuries and annual updates of this deployment injury surveillance report.

(2) Link additional data sources, such as levels IV and V hospitalizations and disability records, to provide an enhanced description of deployment injuries and their outcomes.

(3) Continue investigations that will identify modifiable risk factors that contribute to the leading causes of injury.

(4) Focus attention on strategies that will aid in preventing injuries from sports/physical training, falls/jumps, and land transport mishaps.

(a) Make sure surfaces for sports are level and free of hazards.

(b) Avoid overtraining.

(c) Be cautious when getting on and off vehicles and working around them to avoid falls.

(d) Wear seatbelts when tactical situation permits.

5. SPECIAL ANALYTIC DEPLOYMENT INJURY SURVEILLANCE PROJECT SUMMARIES, 2011.

a. Incidence and Causes of Air-evacuated Non-battle Injuries Among U.S. Army Soldiers Deployed to Iraq and Afghanistan, 2001-2010 (poster: American Public Health Association).

(1) Non-battle injuries represent greater than one-third of all air evacuations out of theater, more than BI or any single disease diagnosis group between years 2001-2010.

(2) This investigation describes the casualty type, incidence, leading causes, injury types, and anatomical locations for NBIs that required air evacuation from Operations Iraqi Freedom/New Dawn (OIF/OND) and Enduring Freedom (OEF) from 2001-2010.

(3) Of the 57,979 Soldiers evacuated, 30-40 percent had an NBI compared to 5-25 percent for BI. Figure 14 shows the annual rates of NBIs from 2001-2010. NBI rates decreased over time for both OIF/OND and OEF. However, from year 2008 there has been a slight increase for both OIF and OEF.

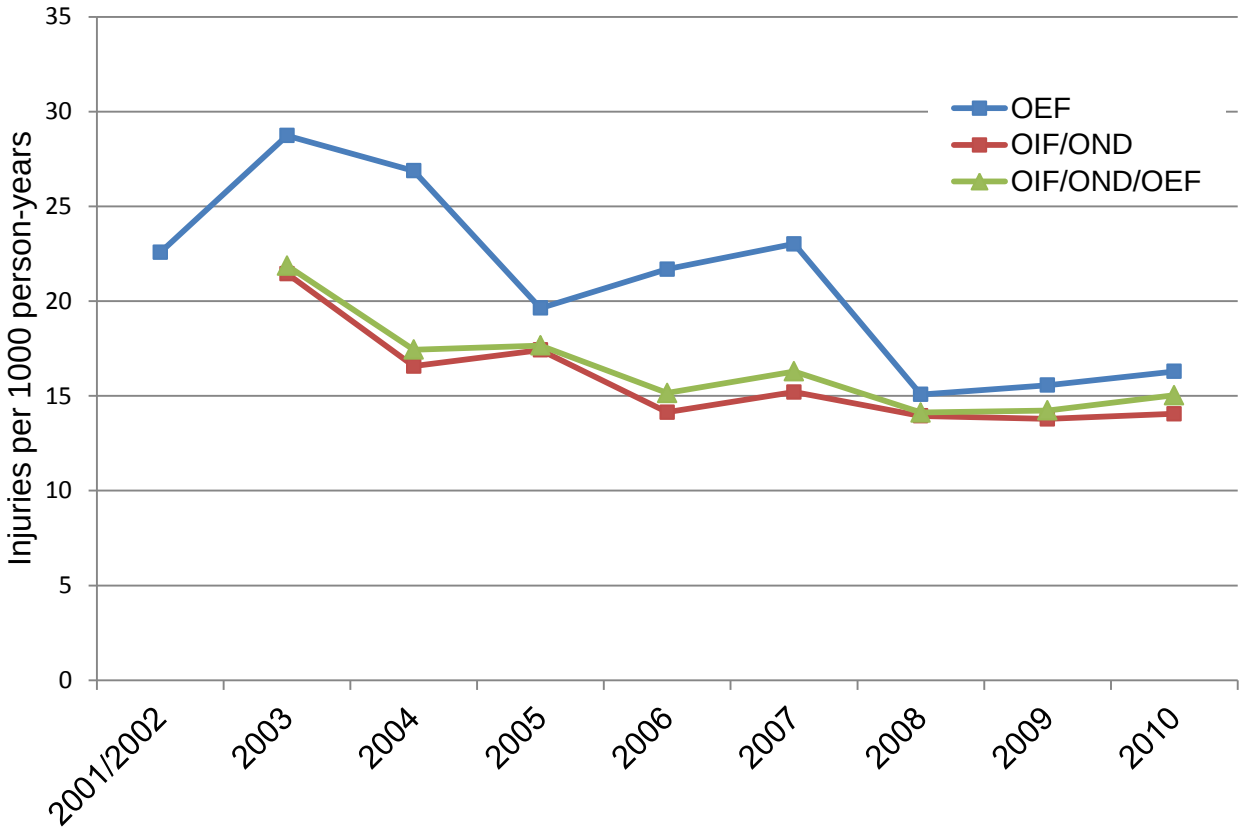


Figure 14. Annual Rates of Non-battle Injuries: OIF/OND/OEF, 2001-2010

(4) The leading causes of NBIs (Figure 15) were sports/physical training (22 percent), falls/jumps (17percent) and land transport accidents (14 percent). The least important causes of NBIs were environmental (2 percent), cutting and piercing (2 percent), and boots, clothing, body armor (3 percent).

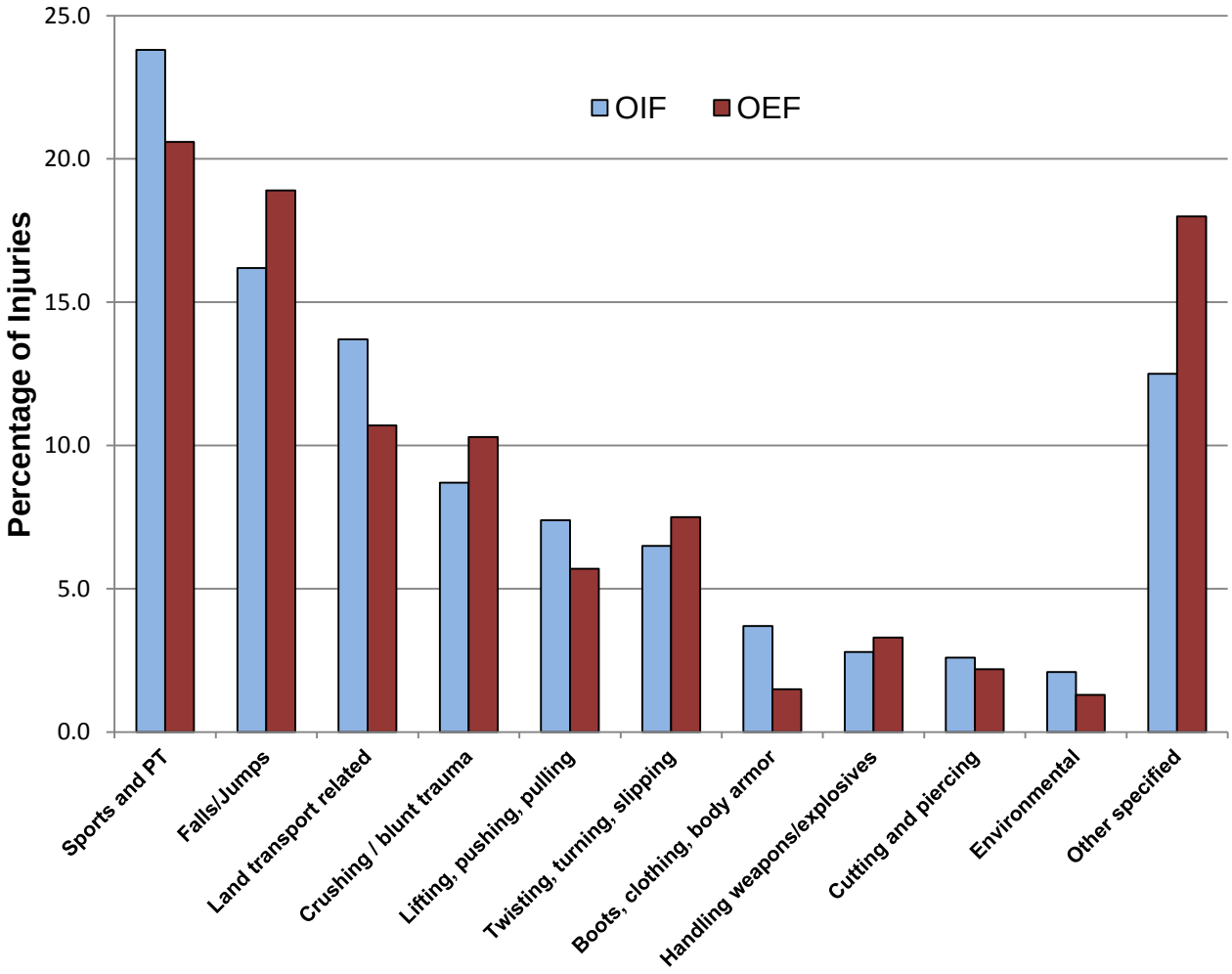


Figure 15. Causes of Non-battle Injuries, OIF/OEF, CY 2001–2010

b. Army Soldier Deployment Injuries OIF and OEF, 2001-2009 (Oral presentation: Force Health Protection Conference).

(1) The total number of medical air evacuations in OIF/OEF was 51,517 from 2001-2009. Thirty-four percent were NBIs and 17 percent were BIs. In OIF there were 3,302 fatalities and 77 percent were from Battle injuries. In OEF there were 731 fatalities and 71percent were from Battle injuries.

(2) Figure 16 shows the anatomic distribution of NBIs from 2001 to 2009. The leading body regions were back (17 percent), knee (16 percent), and wrist/hand (13 percent).

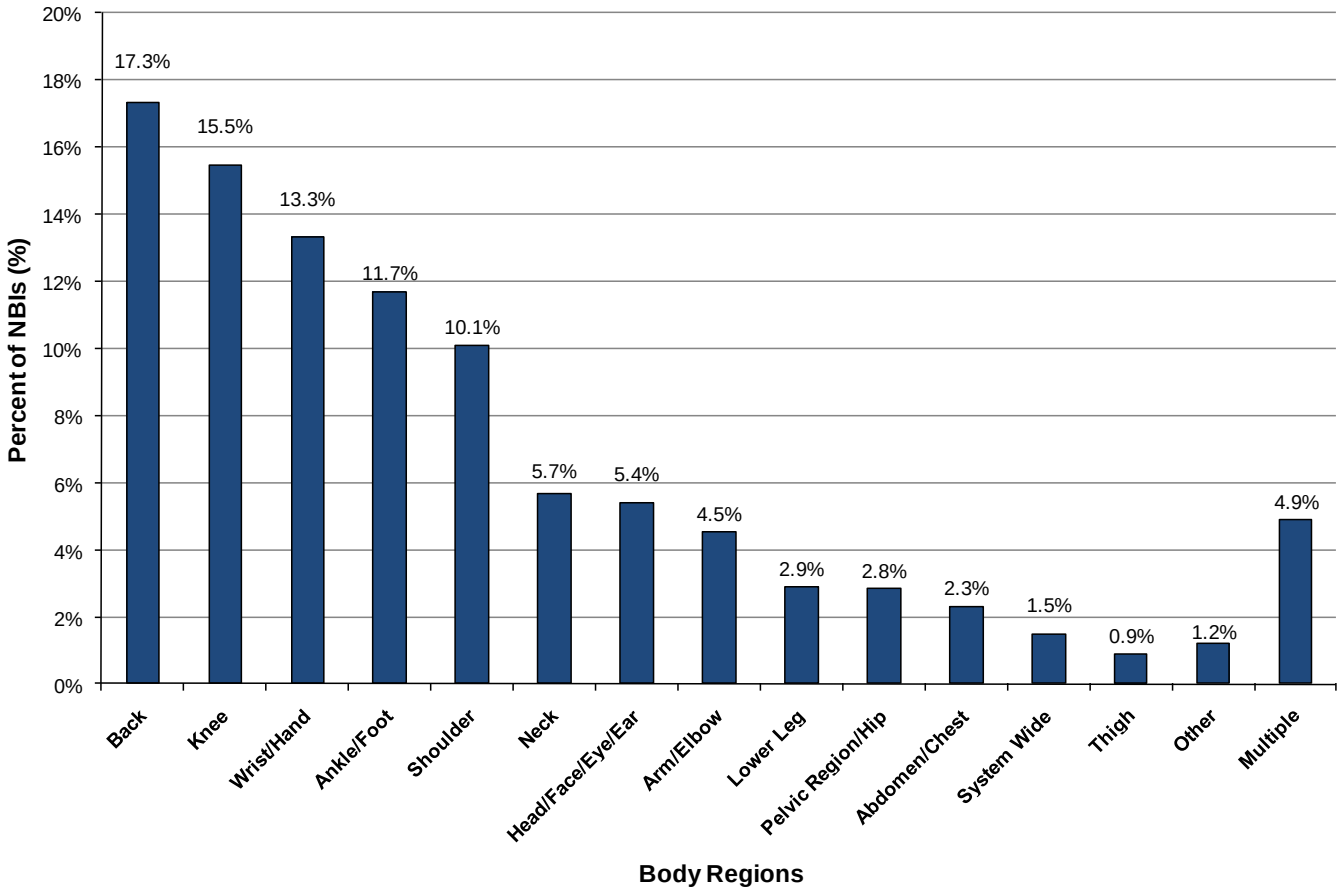


Figure 16. Anatomic Distribution of Non-battle Injuries OIF/OEF, 2001-2009.

(3) Overall, 17,522 Soldiers were air evacuated for NBIs. Of the injuries with an identifiable cause (n=11,784), 22 percent were sports related injuries with basketball (26 percent), physical training (19 percent), and football (17 percent) being the three leading of causes of air evacuated sport injuries (See Table 8).

(5) Swimming/diving (1 percent), Frisbee (1 percent), and boxing (1 percent) represent the lowest percentage of causes of air evacuated sport injuries from 2001-2009.

Table 8. Number of Air Evacuated Sports-related Injuries by Activity, CY 2001-2009

Sport	Frequency (n=2,604)	Percent (%)
Basketball	667	25.6
Physical training	487	18.7
Football	445	17.1
Weight lifting	377	14.5
Wrestling/Unarmed combat training	169	6.5
Softball/baseball	98	3.8
Volleyball	91	3.5
Soccer	78	3.0
Boxing	35	1.3
Frisbee	15	0.6
Swimming/Diving	13	0.5
Other specified	129	5.0

Notes:
*Percent of injuries are within all sports related injuries.

c. Impact of Non-Battle Injuries among Army Soldiers Deployed to Iraq and Afghanistan, 2001-2010 (Poster: American Public Health Association).

(1) Injury is the leading health problem among deployed and non-deployed Army soldiers. For deployed soldiers in Iraq and Afghanistan (2001-2006), injury unrelated to battle or hostile action (non-battle injury [NBI]) was the leading casualty type (34.8%) requiring medical air evacuation from the theater of operations. The purpose of this investigation was to determine the overall impact of serious non-battle injuries (fatal, hospitalized, and air evacuated) among Army soldiers deployed to Iraq and Afghanistan from 2001 to 2010.

(2) Casualty, hospitalization, and air evacuation records were used to identify Army soldiers with NBIs that resulted in death, hospitalization, or medical air evacuation among soldiers deployed to Iraq and Afghanistan from 2001 to 2010. Casualty type, diagnosis, and cause of injury were identified from records.

(3) Overall, 818 soldiers died (7/10,000 person-years), 8,218 were hospitalized (79/10,000 person-years) and 19,618 were air evacuated (169/10,000 person-years) for NBIs. While BI was the leading diagnosis category for fatalities (77.4%) and hospitalizations (23.2%), NBI was the second leading category for both (20.8% and 19.1%, respectively), followed by illness categories. As shown in Figure 17, NBI was the leading diagnosis category for air evacuations (33.8%). The leading cause of fatal and hospitalized NBIs was motor vehicle crashes (32.7% and 16.45%, respectively), while sports/exercise were the leading cause (23.0%) for air evacuated NBIs.

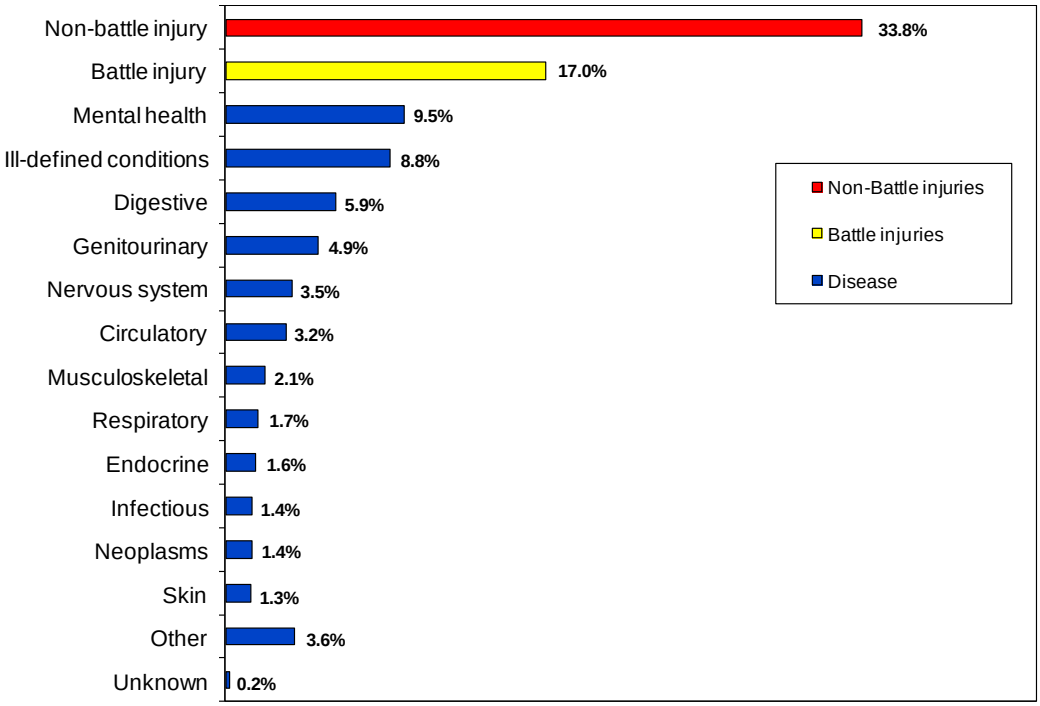


Figure 17. Distribution of Primary Diagnosis Groups for Soldiers Hospitalized in Iraq and Afghanistan, 2001-2010

(4) As the second leading casualty category for fatalities and hospitalizations, and the leading category for air evacuations, NBIs greatly impact the health, resources, and operational readiness of deployed units. Prevention of the leading causes of NBI should be a top priority for the Army.

d. Army Deployment Injury Surveillance: Methods and Analysis. (Force Health Protection Conference, 2011)

(1) Surveillance Methods Workshop to understand the service surveillance mission, open communication lines where appropriate, seek opportunities to share methods, and better understand data strengths and limitations with respect to surveillance.

(2) Methods and analysis of Army deployment surveillance presented at the Force Health Protection Conference with Army, Navy, and Air Force representatives.

(3) Data sources, as well as results of air evacuation, hospitalization, and fatality surveillance were presented.

e. Conclusions from *Special Analytic Deployment Injury Surveillance Project Summaries, 2011*.

(1) From 2001-2010, the annual NBI evacuation rate was almost two times higher than that for BI (NBI: 30-40 percent; BI: 5-25 percent). The leading causes of NBI evacuations for OIF and OEF combined were sports and PT, falls and jumps, and land transport accidents.

(2) From 2001-2009, back injuries were the leading anatomic location (17 percent) of NBIs air evacuated from Iraq and Afghanistan. These injuries, many of which are preventable, negatively impact Soldier work performance and unit readiness during deployments.

(3) Sports and exercise-related injuries comprised 22 percent of the NBIs air evacuated from Iraq and Afghanistan from 2001 to 2009. Due to the impact of these injuries on lost duty time and military readiness, identifying, evaluating, and implementing strategies to prevent them should be a high priority for military leaders.

(4) During the current Army deployments in Iraq and Afghanistan from 2001 to 2010, non-battle injuries have represented an important and often under-recognized health problem for deployed soldiers. During this period, serious non-battle injuries affected a total of 28,654 Soldiers (818 died; 8,218 were hospitalized; and 19,618 were air evacuated). The overall injury rate considering all three categories of non-battle injury was 244 injuries/10,000 person-years.

f. Recommendations for Commanders.

(1) Use evidence-based countermeasures and safety guidelines to lower the injury risk.[33]

(2) Leaders and Soldiers should use composite risk management to identify hazards and control risks across all Army missions and activities.

(3) Timely and accurate reporting is critical any time a mishap occurs. It is imperative that all accidents are investigated and reported.

(4) Focus attention of strategies that will aid in preventing injuries from leading causes of injury.

(a) To prevent sports and physical training injuries:

i. Avoid training too hard or too long when beginning or changing activities.

ii. Gradually increase how often and how long you train after a break in training due to leave, illness, or redeployment.

(b) To prevent motor-vehicle related injuries:

i. Use ground guides to ensure vehicles are not traveling too fast for high risk or heavily populated areas. Train all personnel when to use ground guides and how to execute ground-guiding procedures.

ii. Secure personnel and cargo – seat belts and gunner restraints save lives and prevent injury.

iii. Rehearse rollover, emergency egress, and rescue drills prior to each mission.

iv. Establish and enforce safe speed limits for the road and environment.

(c) To prevent fall-related injuries:

i. Inspect the facilities on the operating base to identify and remove hazards that may lead to slips, trips, and falls indoors and outdoors.

ii. Remove trip hazards from sidelines of basketball courts and sport fields.

iii. When feasible, ensure personnel use fall protection when working at heights.

iv. Conduct spot checks to ensure appropriate guards and barriers are in place.

6. POINT OF CONTACT. The point of contact at USAPHC is the Epidemiology and Disease Surveillance Portfolio, Injury Prevention Program, commercial 410-436-4655 or DSN 584-4655. Inquiries may also be submitted electronically at usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil.

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APPENDIX A

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APPENDIX B

TABLE B-1. BARELL INJURY DIAGNOSIS MATRIX AND ASSOCIATED ICD-9-CM 800-995 CODES

			ICD-9-CM codes	FRACTURE 800-829	DISLOCATION 830-839	SPRAINS & STRAINS 840-848	INTERNAL 360-364,380-389 862, 866.66	OPEN WOUND 870-884, 890-894	AMPUTATIONS 885-887, 896-897	BLOOD VESSELS 900-904	CONTUSION / SUPERFICIAL 910-924	CRUSH 926-929	BURNS 940-948	NERVES 950-951 862-867	UNSPECIFIED 869
Head and Neck	Traumatic Brain Injury	1 Type 1 TBI	800,801,803,804(.1-.4,.6-.9) (.00-.05,.53-.55) 850(.2-.4), 851-854, 950(.1-.3), 995.55	800,801,803,804(.1-.4,.6-.9) 800,801,803,804(.00-.05,.53-.55)	/	/	850(.2-.4) 851-854*, 995.55	/	/	/	/	/	/	950.1-.3	/
		2 Type 2 TBI	800,801,803,804(.00,.02,.05,.09) (.50,.52,.56,.59) ,850(.0,.1,.5,.9)	800,801,803,804(.00,.02,.05,.09), 800,801,803,804(.50,.52,.56,.59)			850(.0,.1,.5,.9)								
		3 Type 3 TBI	800,801,803,804(.01, .51)	800,801,803,804(.01,.51)	/	/	/	/	/	/	/	/	/	/	/
	Other Head, Face and neck	4 Other Head	873(.0-.1,.8-.9),941.06,951,959.01	/	/	/	/	8730-.1,.8-.9	/	/	/	/	941.06	951	959.01*
		5 Face	802, 830, 848.0-.1, 872, 873.2-.7, 941(.01,.03-.05,.07)	802	830	8480-.1	/	872, 873.2-.7	/	/	/	/	941.01,.03-.05,.07	/	/
		6 Eye	870-871, 918, 921, 940, 941.02, 950(.0,.5)	/	/	/	/	870-871	/	/	918, 921	/	940, 941.02	950(.0,.5)	/
		7 Neck	807.5-.6, 848.2, 874, 925.2, 941.08, 953.0, 954.0	807.5-.6	/	848.2	/	874	/	/	/	925.2	941.08	9530, 954.0	/
		8 Head, Face and Neck Unspecified	900, 910, 920, 925.1, 941.00, .09, 947.0, 957.0, 959.09	/	/	/	/	/	/	900	910, 920	925.1	941.00,.09, 947.0	957.0	959.09
Spine and Back	Spinal Cord (SCI)	9 Cervical SCI	806.0-.1), 952.0	806.0-.1	/	/	952.0	/	/	/	/	/	/	/	/
		10 Thoracic, Dorsal SCI	806.2-.3), 952.1	806.2-.3	/	/	952.1	/	/	/	/	/	/	/	/
		11 Lumbar SCI	806.4-.5), 952.2	806.4-.5	/	/	952.2	/	/	/	/	/	/	/	/
		12 Sacrum, Coccyx SCI	806.6-.7), 952(.3-.4)	806.6-.7	/	/	952.3-.4	/	/	/	/	/	/	/	/
		13 Spine+ Back unspecified SCI	806.8-.9), 952(.8-.9)	806.8-.9	/	/	952.8-.9	/	/	/	/	/	/	/	/
	Vertebral Column (VCI)	14 Cervical VCI	805.0-.1), 839.0-.1), 847.0	805.0-.1	839.0-.1	847.0	/	/	/	/	/	/	/	/	/
		15 Thoracic, Dorsal VCI	805.2-.3), 839(.21,.31), 847.1	805.2-.3	839.21,.31	847.1	/	/	/	/	/	/	/	/	/
		16 Lumbar VCI	805.4-.5), 839(.20,.30), 847.2	805.4-.5	839.20,.30	847.2	/	/	/	/	/	/	/	/	/
		17 Sacrum, Coccyx VCI	805.6-.7), 839(.41-.42), 839(.51-.52), 847.3-.4	805.6-.7	839(.41-.42, .51-.52)	847.3-.4	/	/	/	/	/	/	/	/	/
		18 Spine+ Back unspecified VCI	805.8-.9), 839(.40,.49), 839(.50,.59)	805.8-.9	839(.40,.49,.50,.59)	/	/	/	/	/	/	/	/	/	/
Torso	Torso	19 Chest / Thorax	807.0-.4), 839(.61,.71), 848(.3-.4), 860-862, 875, 879(.0-.1), 901, 922(.0-.1,.33), 926.19, 942.01-.02 953.1	807.0-.4	839.61,.71	848.3-.4	860-862	875, 879.0-.1	/	901	922(.0,.1,.33)	926.19	942.01-.02	953.1	/
		20 Abdomen	863-866, 868, 879(.2-.5), 902(.0-.4), 922.2,942.03, 947.3, 953(.2,.5)	/	/	/	863-866, 868	879.2-.5	/	902.0-.4	922.2	/	942.03, 947.3	9532, 953.5	/
		21 Pelvis & Unspecified	808, 839(.69,.79), 846, 848.5, 867, 877-878 902(.5, .81-.82), 922.4, 926(.0,.12), 942.05,947.4, 9533	808	839.69,.79	846, 848.5	867	877-878	/	902(.5, .81-.82)	922.4	926(.0, .12)	942.05, 947.4	953.3	/
		22 Trunk	809, 879(.6-.7), 911, 922(.8-.9), 926(.8-.9), 942(.00,.09), 954(.1,.8-.9), 959.1	809	/	/	/	879.6-.7	/	/	911, 922.8-.9	926.8-.9	942.00,942.09	954.1, .8-.9	959.1
		23 Back and Buttock	847.9, 876, 922(.31-.32), 926.11, 942.04	/	/	847.9	/	876	/	/	922.31-.32	926.11	942.04	/	/
Extremities	Upper	24 Shoulder & upper arm	810-812, 831, 840, 880, 887(.2-.3), 912,923.0, 927.0,943(.03-.06) 959.2	810-812	831	840	880	887.2-.3	/	912, 9230	927.0	943.03-.06	/	959.2	
		25 Forearm & elbow	813, 832, 841, 881(.00-.01), 887(.0-.1), 923.1, 927.1, 943(.01-.02)	813	832	841	/	881.00-.01	887.0-.1	/	923.1	927.1	943.01-.02	/	/
		26 Wrist, hand & fingers	814-817, 833-834, 842, 881.02, 882, 883, 885-886, 914-915, 923(.2-.3) ,927(.2-.3), 944, 955(.4-.5)	814-817	833, 834	842 / /	/ / /	881.02 882, 883	/ 885-886	/ / /	914-915, 923.2-.3	927.2-.3	944 / /	/ / /	959.4-.5
		27 Other & unspecified	818, 884, 887(.4-.7), 903,913, 923(.8-.9), 927(.8-.9), 943(.00,.09), 953.4, 955, 959.3	818	/	/	/	884	887.4-.7	903	913,923.8,9	927.8-.9	943.00,.09	953.4, 955	959.3
	Lower	28 Hip	820, 835, 843, 924.01, 928.01	820	835	843	/	/	/	/	924.01	928.01	/	/	/
		29 Upper leg & thigh	821, 897(.2-.3), 924.00, 928.00, 945.06	821			/	/	897.2-.3	/	924.00	928.00	945.06	/	/
		30 Knee	822, 836, 844.0-.3, 924.11, 928.11, 945.05	822	836	844.0-.3	/	/	/	/	924.11	928.11	945.05	/	/
		31 Lower leg & ankle	823-824, 837, 845.0, 897(.0-.1), 924(.10,.21), 928(.10,.21), 945(.03-.04)	823-824	837	8450	/		897.0-.1	/	924.10,.21	928.10,.21	945.03-.04	/	/
		32 Foot & toes	825-826, 838, 845.1, 892-893, 895-896, 917, 924(.3,.20), 928(.3,.20), 945(.1-.2)	825-826	838	845.1	/	892-893	895-896	/	917, 924.3,.20	928.3,.20	945.01-.02	/	/
		33 Other & unspecified	827, 844(.8-.9), 890-891, 894, 897(.4-.7), 904(.0-.8), 916, 924(.4-.5), 928(.8-.9), 945(.00,.09), 959.6-.7	827	/	844.8,.9	/	890-891,894	897.4-.7	904.0-.8	916, 924.4-.5	928.8,.9	945.00-.09	/	959.6-.7
Unclassifiable by site	Other & unspecified	34 Other multiple	819, 828, 902(.87,.89), 947(.1-.2), 953.8, 956	819, 828	/	/	/	/	/	902.87,.89	/	/	947.1-.2	953.8, 956	/
		35 Unspecified site	829, 839(.8-.9), 848(.8-.9), 868, 879(.8,.9), 902.9, 904.9, 919, 924(.8,.9), 928(.8,.9), 946, 947(.8,.9), 948, 949, 9539, 957(.1,.8,.9), 958(.8,.9)	829	839.8-.9	8488-.9	868	879(.8-.9)	/	902.9, 904.9	919, 924.8,.9	929	946, 947.8,.9 948, 949	9538, 957.1,.8,.9	959.8,.9
	System-wide	36 System-wide & late effects	905-908, 909(.0,.1,.2,.4,.5), 930-939,958, 960-994, 995.50-.54,.59, 996(.80-.85)	Foreign body (930-939), Early complications of trauma (958), Poisoning (960-979), Toxic Effects (980-989), Other and unspecified effects of external cause (990-994) Child and adult maltreatment (995.50-.54,.59, 995.80-.85) Late effects of injuries ,poisonings, toxic effects and other external causes (905-909) excluding 905(.3, .5)											

APPENDIX C

TABLE C-1. INJURY-RELATED MUSCULOSKELETAL CONDITION MATRIX AND ASSOCIATED ICD-9-CM 710-739 CODES

Injury Location			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological Involvement	Stress Fracture	Sprains/Strains/ Rupture	Dislocation
	Vertebral Column	Cervical	723.1	722.0	722.71, 723.4			
		Thoracic/Dorsal		722.11	722.72, 724.4			
		Lumbar	724.2	722.10	722.73, 724.3			
		Sacrum, Coccyx	720.2					
		Spine, Back Unspecified	721.7, 724.5	722.2	722.70, 724.9	733.13		
Extremities	Upper	Shoulder	716.11, 719(.01,.11,.41), 726(.0,.1,.2)	718(.01,.11,.81,.91)			727(.61-.62)	718.31
		Upper arm, Elbow	716.12, 719(.02,.12,.42), 726.3	718(.02,.12,.82,.92)		733.11		718.32
		Forearm, Wrist	716.13, 719(.03,.13,.43), 726.4	718(.03,.13,.83,.93)		733.12		718.33
		Hand	716.14, 719(.04,.14,.44)	718(.04,.14,.84,.94)			727(.63-.64)	718.34
	Lower	Pelvis, Hip, Thigh	716.15, 719 (.05,.15,.45), 726.5	718(.05,.15,.85,.95)		733(.14-.15)	727.65	718.35
		Knee, Lower leg	716.16, 717.7, 719(.06,.16,.46), 726.6	717(.0-.6,.9), 718(.06,.16,.86,.96)		733(.16,.93)	717.8, 727(.66-.67)	718.36
		Ankle, Foot	716.17, 719(.07,.17,.47), 726.7, 728.71, 734	718(.07,.17,.87,.97)		733.94	727.68	718.37
Unclassified by Site	Others and Unspecified	Other specified/Multiple	716(.18-.19), 719(.08-.09,.18-.19,.48-.49), 726.8, 727.2	718(.08,.09,.18,.19,.88,.89,.98,.99)		733.19	727.69	718(.38,.39)
		Unspecified Site	716.10, 719(.00,.10,.40), 726.9, 727.3, 729.1	718(.00,.10,.80,.90)	729.2	733(.10,.95)	727.60, 728.83	718.30